

AIRGUN ODYSSEY

by

STEVE HANSON

Guest Chapters by

KEN REEVES and LARRY DURHAM





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Published by Precision Shooting, Inc.

Caution:

Throughout these pages appear reports about airgun tunes as well as trigger tunes. It is always best to check with the manufacturer to ascertain any warranty change before attempting any airgun tune or modification procedure. Some procedures may void an item's warranty.

Furthermore, airguns are unique in that they store the propelling power within the gun. Spring-powered guns can project their springs and parts with enough force to kill or maim. Air pressurized guns and scuba tanks can also throw parts and act like an unguided missile if ruptured or damaged. Perform no airgun modifications or adjustments unless you are a trained professional in this regard. Airguns are not toys and are not recommended for anyone under 18 unless under adult supervision and training. Never point a gun at something unless you intend to shoot it. Safety glasses or goggles are always recommended when shooting airguns.

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Dedication

I would like to dedicate this book to all past and present airgun entrepreneurs whose vision and foresight have brought into the world many new innovations and products that have proved to be beneficial and have also brought much joy to so many new shooters.

Steve Hanson

Introduction

I still remember a most historical moment in my life — I was six years old when I shot my first BB gun. I hit my first target with my first shot too! Of course missing a target as large as the one I had shot at would have been difficult; it was the broad side of a metal barn.

Growing up with airguns and progressing to firearms seemed to be a natural and logical evolutionary event. Indeed, firearms expanded my long range shooting repertoire tenfold. However, I have always maintained an airgun battery and remained intrigued by airguns in general. Airguns have always entranced me, and to this day there seems to be an airgun mystique that just won't fade.

Airgun popularity has grown considerably during the past two decades. Despite the current popularity of airguns, it appears to this author that airgun shooting, in general, by most of the firearm shooting clan is still considerably under-utilized. Airguns are simply more convenient and less costly to shoot than firearms. Additional practice with airguns leads to enhanced shooting skills — certainly a worthwhile progression, and one which the serious student of precision shooting has always been striving for.

Airguns, by their very nature, can be utilized very unobtrusively, yet effectively, in areas

that are forbidden to even the quietest of firearms. Airgun accuracy can be surprisingly good, and many times exceeds all expectations. Accuracy (within range) can rival the best rimfire cartridges and firearms. In fact, the high end world-class match air rifle is considered by many to be the most accurate shooting instrument in the world!

Many airgunners discover that airgun hunting can be somewhat paradoxical, by reasons of being both stimulating and relaxing, yet, at the same time not overly simplified. Stalking and shooting, within the limits of an airgun, can reward the hunter with great satisfaction and accomplishment that seems far out of proportion to the actual shooting distance and size of the game involved.

Live quarry, field targets, or target competition, whatever the quest, shooting airguns can be very challenging at times, and yet without this very challenge the rewards would seem diminished and the contest would be less meaningful. May the airgun mystique remain with us forever.

Steve Hanson
Tacoma, Washington

THE HISTORY OF THE

The history of the world is a story of the human race, of its struggles, its triumphs, its failures, and its progress. It is a story of the human mind, of its discoveries, its inventions, its art, and its science. It is a story of the human heart, of its loves, its hates, its hopes, and its fears. It is a story of the human spirit, of its courage, its faith, its hope, and its charity. It is a story of the human race, of its struggles, its triumphs, its failures, and its progress. It is a story of the human mind, of its discoveries, its inventions, its art, and its science. It is a story of the human heart, of its loves, its hates, its hopes, and its fears. It is a story of the human spirit, of its courage, its faith, its hope, and its charity.

THE HISTORY OF THE

CHAPTER ONE

Airgun *Evolution & Trends*



Photo courtesy of Daisy Mfg. Co.

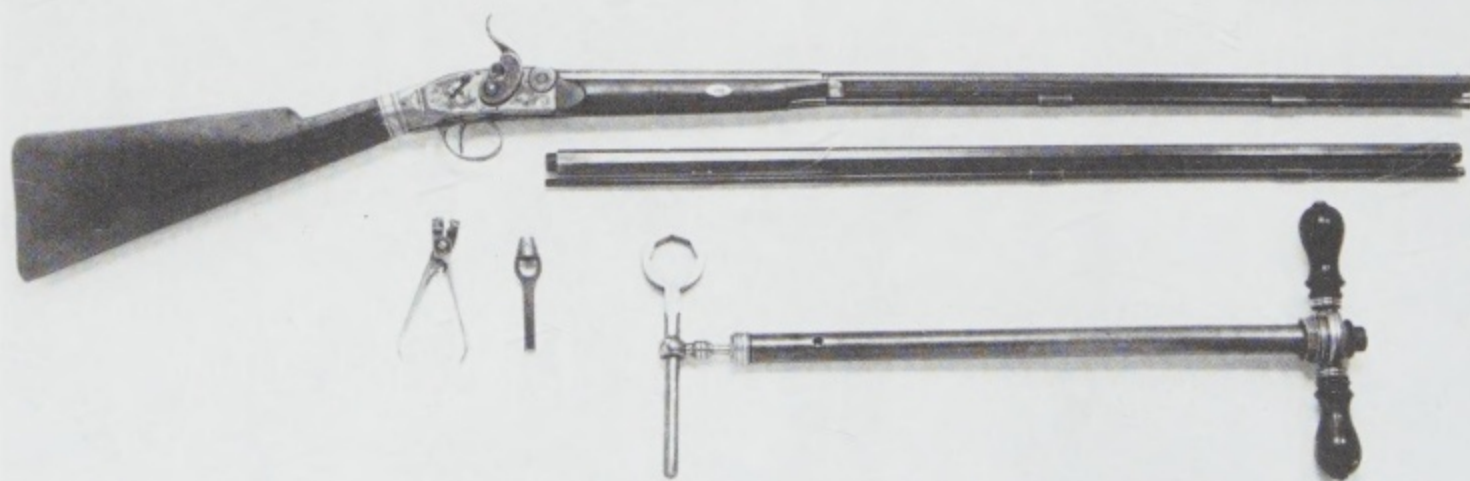
Airgun enthusiasts are lucky indeed to be living in such interesting times. The past decade has brought forth so many mechanical airgun marvels that it is nearly impossible to stay informed about all the latest up to the minute airgun innovations. Besides the advances in airgun mechanics, the past decade or so has also shown an improvement in airgun ammunition. This surge in airgun popularity has been fueling new airgun companies, while the old stalwarts continue to thrive in the new millennium. A self fulfilling prophecy seems to have escalated new high-tech and accurate airguns, which in turn lures more shooters into the fray, who in turn crave for yet more sophistication, accuracy and power. Then the cycle repeats itself! We will take a peek at what has come down the pike so far.

Dedicated firearm shooters are a new faction that are expanding their shooting experiences and are swaying towards airguns in waves. However, there are subtle yet not immediately apparent differences and quirks between firearms and airguns that most newcomers to airgunning are not usually aware of. The new airgun shooter should certainly be cognizant about the little quirks and nuances before buying a stable of airguns. More models of airguns are being introduced than ever before, and it can get quite confusing at times. Are you searching for that just-right airgun that fits a particular need or shooting style? A modicum of shooting experience with different types and different brands of airguns combined with airgun study will help you sort out the details; subsequently, it should be easier to make intelligent airgun decisions.

History

Historically, the most famous airgun around is probably the one that famed explorers Meriwether Lewis and William Clark carried while exploring the West. The type of air rifle that Lewis and Clark shot was a .31 caliber butt-stock-reservoir pneumatic made by Lukens of Philadelphia. This pneumatic muzzle loader could be fired at least 40 times from a single charge, moreover it could be shot much more rapidly than firearms of the same period. The National Rifle Association has an example of this type of an airgun in their firearms museum. Legend has it that the airgun was used to take a few deer and was also used as a conversation piece to amaze the Indians.

In America during the second half of the 1800's, the spring-piston airgun had progressed to a point where it was powerful and useful, albeit also expensive. The spring-piston airgun probably reached its pinnacle after the Civil War in the form of sophisticated gallery guns. On the other side of the Atlantic the pneumatic type of airgun ruled the roost and was considered a sophisticated weapon. In 1889 a French inventor, Paul Giffard, introduced the first CO₂ gas airguns with the exquisite (and now very rare) Giffard gas rifles and gas pistols. Impressionable French journalists at the time hailed the Giffard rifle as a new revolutionary, super-power rifle suitable for warfare! The Giffard rifle, of course, didn't produce nearly the power needed for warfare, but it did help to spawn other gas guns.



Early explorers Lewis and Clark packed a .31 caliber butt reservoir air rifle. Pictured above is an airgun of that type. Attaching the separate hand pump and pumping in about 200 strokes, charges the gun. Such a charge was good for about 40 shots. — Photo courtesy of Beeman Precision Airguns.



Gun training and marksmanship is commonly passed on from generation to generation — compliments of the airgun. Here a Daisy Red Rider BB gun serves the purpose and provides family fun. — Photo courtesy of Daisy Mfg. Co.

A rather strange turn of events happened in the 1900's regarding airgun evolution. The development of smokeless powder and the firearm cartridge just about nixed the progression of the super-powerful airgun. Europe started producing sophisticated spring-piston airguns, and their previously popular pneumatics and CO₂ guns just about vanished. In the meantime, the Americans were marketing mass produced and low-powered spring-piston BB guns mixed with better pump-up pneumatics and CO₂ powered airguns to their younger generation. This reversal of airgun technology between Europe and America had profound implications down the road.

Meanwhile, the Europeans regarded their airguns as adult type guns and were marketed for an adult audience. In Europe, and particularly in England, small game hunting with airguns was (and still is) a rather common sport. The short range pellet gun worked well within their hearty population density and the lay of the land, not to mention that their more restrictive gun laws frowned upon actual cartridge-firearms. As an aside, in England you need a FAC (Firearms Acquisition Certificate) from the police in order to own a shotgun or a *magnum type airgun*. (Yes, in England a FAC is required if you own an air rifle that exceeds 12 foot pounds of muzzle energy or an air pistol that exceeds approximately 6 foot pounds of muzzle energy).

During the first half of the 20th century most Americans regarded the airgun as a child's toy. This was the time when the American BB gun reigned supreme among our youth, and served as a stepping stone to the "ultimate" shooting quest — the firearm. Yes, the common BB gun was somewhat crude and low-powered, but provided basic gun training and taught youngsters the importance of gun safety. With the exception of a half-dozen or so models, the adult airgun market in America was for the most part ignored altogether. This trend lasted up until the latter part of the 1960's when a few of the more sophisticated European *Adult* airguns started to become noticed and, subsequently were taken more seriously here in the United States.

Don't read me wrong here because there were indeed some mighty fine American airguns, but only a relatively small number of adult airgun buffs at the time were shooting these prized specimens. Some of the better models that come to mind include: The Crosman 160 - dual CO₂ gas rifle, Crosman 1400 pneumatic rifle, Crosman model 84 CO₂ match rifle and model 88 CO₂ match pistol (which were introduced in the 1980's), Sheridan Super-Grade and Sheridan Blue & Silver Streak pneumatic rifles, the Benjamin 340 series pneumatic rifles, and the Daisy model 753 pneumatic match rifle, and model 777 pneumatic match pistol, (which were also introduced in the 1980's).

During the early 1960's Robert Law started a new company called Air Rifle Headquarters which specialized in German and British airguns. The European spring-piston powered pellet gun was largely an unknown gun to most Americans.



Airguns marketed for adults are quite popular these days. — Photo courtesy of Daisy Mfg. Co.



The Daisy Red Rider BB rifle — a perennial kids' favorite since 1938. The Author's son Jason is presently training with such an airgun. — Photo courtesy of Daisy Mfg. Co.

It took awhile, but when the word became widely heard about the accuracy and power of European spring-piston propulsion types — they started to rise in popularity among American *adult shooters*. Air Rifle Headquarters served an important part in introducing and educating the American shooter about the hunting potential and match-grade accuracy of airguns. (Unfortunately, Air Rifle Headquarters went out of business around the early 1980's).

Robert Beeman started Beeman Precision Arms in 1972 and later Dynamit Nobel- RWS Inc. also came upon the American airgun scene. Both of these companies specialized in importing high quality European airguns into the United States (and still do). Both Beeman (now called Beeman Precision Airguns a division of S/R Industries, which includes Marksman Products) and RWS became major players in the airgun market and helped to popularize the adult airgun theme.

In America during the latter part of the 1970's and into the 1980's the pellet gun was gaining acceptance as a more sophisticated and accurate adult gun. To a large extent the perception of the

airgun changed, replacing the old connotation that all airguns were youth oriented, low-powered BB guns. The new "magnum" powered airgun (i.e. an airgun that produces over 12 foot pounds of muzzle energy) was promoted towards the American shooter as the ideal tool for suburban hunting and pest control. Americans learned that pellet rifles could be shot without complaints in areas that were noise sensitive to even the report of a rimfire type of firearm. The limited range, penetration, and low ricochet propensity of airgun pellets make airguns far safer than firearms in semi-populated suburban areas. Because of increasing urban sprawl large open expanses of land were shrinking which made finding suitable and safe areas for firearm shooting that much more difficult. The arrival of the adult airgun was very well received in semi-suburban areas. Nowadays, airgun shooting is a common sight in many suburban and small-farm areas.

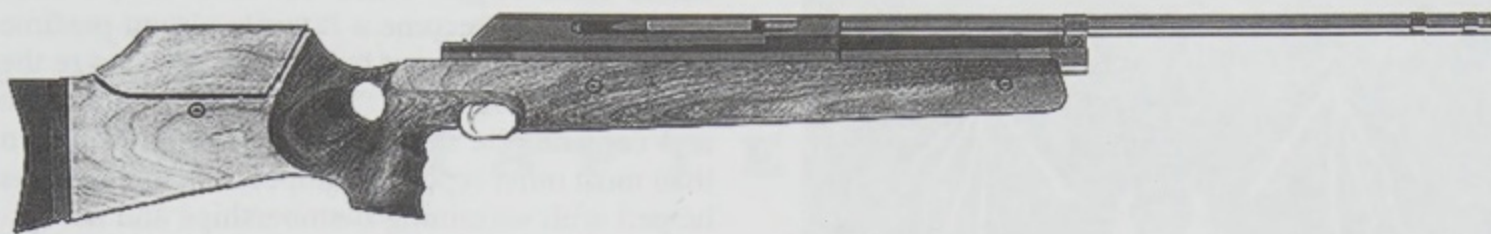
Many full-line firearm retailers have displays setup featuring a complete price range of airguns. The airgun exclusive dealer has also become quite numerous along with the airgun importer. Small custom air-gunsmith shops are also becoming more common these days — these types of shops are specialists in airgun tune-ups and airgun modifications.

The BB gun is still popular among youngsters and many are bought by parents to be used as teaching tools and trainer guns. Basic gun safety is probably best observed and practiced when instilled in our youth at a young age, thus the "lowly" BB gun still serves a vital function. I bet that gun accidents would be an even rarer occurrence if only basic gun safety instructions were learned and adhered to by all our younger citizens.

The profound implications mentioned earlier were in regard to the current American airgun



Pictured above is the Author's son Jason shooting his Daisy Red Ryder BB rifle.



At the top end of the air rifle spectrum is the exquisite dual spring-piston powered Whiscombe JW-80 FB MK II. — Photo courtesy of Harry Steiber and Pelaire Products.

market. The airgun business is booming yet most adult airguns are imported into America from Europe and Korea. American airgun companies have been playing “catch-up” to the Europeans for decades. If the American adult market for airguns was realized sooner, who knows what sophisticated American airguns we might be shooting now?

The race for power started in the late 1970’s with a handful of British and West German spring-piston powered models. The magnum airgun became quite the rage (and still is) as the Europeans aimed their sights on the American market. The pre-charged pneumatic or PCP powered airguns soon surpassed the power provided by the spring-piston types. Joining in the power “marathon” was the newer gas-spring (sometimes called gas-ram) type of airgun. The gas-spring powered airgun soon became the temporary power champ. However, the current “top dog” in

the race for power was regained by the PCP type of airgun which, by the way, is generally “fueled” by a scuba tank of compressed air.

Currently the American airgun companies seem to be covering for the most part the low to medium price range of airguns. The Europeans are supplying most of the top-end magnum rated airguns and ultra-accurate target grade airguns, while the Korean and Philippine airgun factories are producing some of the most modern and powerful pre-charged pneumatics that are currently on the world market (some models produce over 100 foot pounds of energy).

Airgun Competition

The past 30 years or so have shown a dramatic increase in the popularity of airgun competition. In 1984 air rifle shooting earned Olympic status, and ever since airgun competition has been a



Mike Edwards, shooting a discontinued (albeit highly coveted) world-class Crosman model 84 CO₂ Match target rifle.



A typical field target, the target above came from Ron Juneau's Cajun Targets. The goal is to shoot a pellet through the aperture or hit-zone, which knocks the entire target over.

regular part of the Olympics. In 1988 air-pistol competition earned Olympic status, too. This fact alone has made airguns more popular and attracts more shooters every year to the sport.

The standard 10 meter standing air rifle match may look fairly easy, that is until you realize the 10-ring measures just one millimeter in diameter and only diopter type peep sights are allowed!

The most popular event is probably Running Target. In this event a target which consists of twin bullseyes moves across an opening only two meters wide and at two different speeds. The slow run has the target floating across the opening in five seconds, while the faster run is completed in a speedy 2.5 seconds! Highly specialized Running Target air rifles are the norm in this type of competition which, by the way, are also somewhat expensive.

The National Rifle Association would be the organization to contact regarding the various matches and qualifications. The NRA has also sponsored special matches just for the handicapped. In fact, the NRA has a complete department devoted to airgun usage and competition. The Daisy Mfg. Company and the U.S Jaycees also co-sponsor several matches for young shooters, such as a 5-meter BB gun event and a 25-foot program for all types of air rifles and air pistols.

Ardent airgun enthusiasts on the other side of the Atlantic — meaning the British — started their own style of metallic silhouette competition

called field target. Since the mid 1980's field target has also become a favorite airgun pastime in the U.S. Field target has helped popularize the airgun culture greatly. The general atmosphere and camaraderie of field target is more relaxed than most other types of competition, and this has helped with sustaining memberships and accepting new shooters. This type of metallic silhouette competition uses painted steel targets in the configuration of various animals. Field target competition has, by the way, helped to create some very advanced air rifles. The field target enthusiast requires a flat shooting, accurate, and fairly powerful air rifle. Field target rifles will be discussed in more detail in a separate chapter.

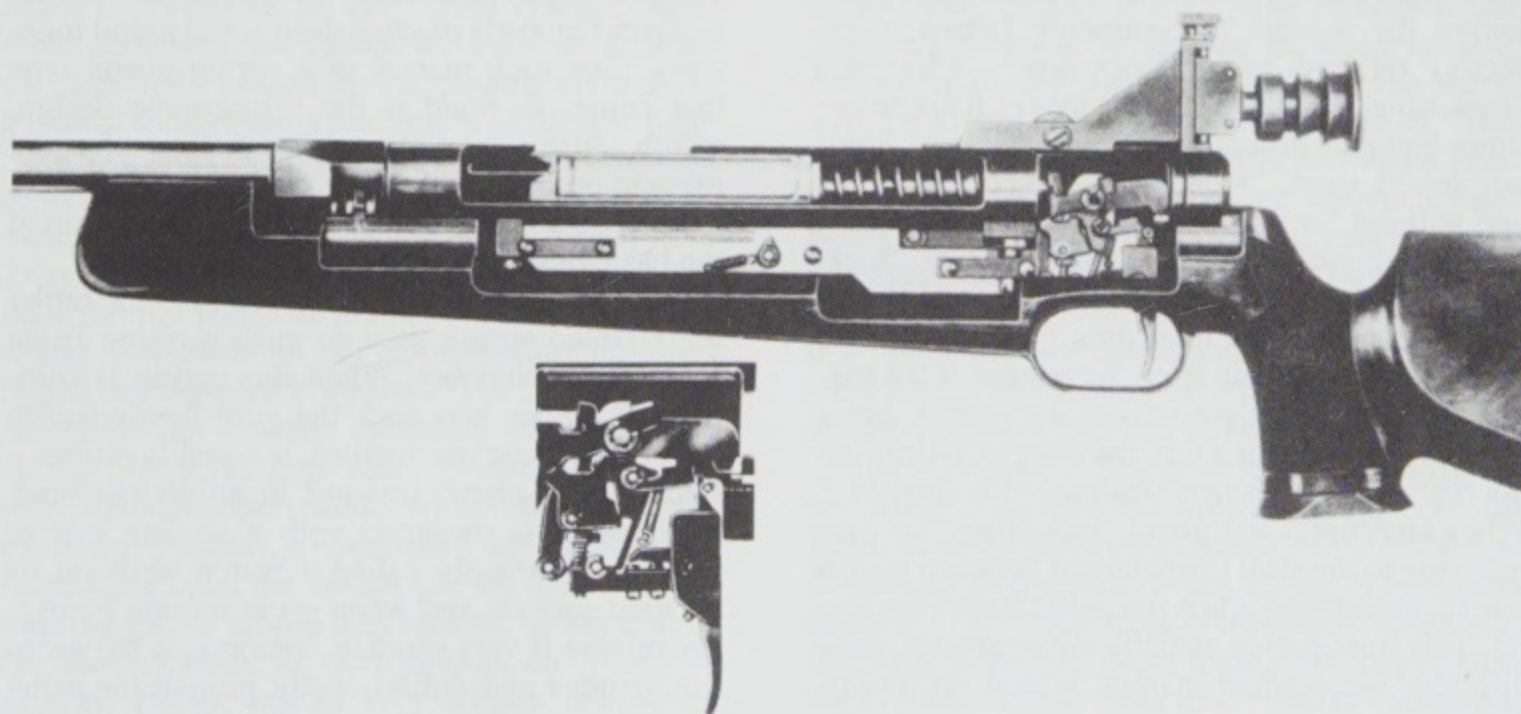
You may have noticed with my drift that it is common for an airgun enthusiast to progress and expand his or her shooting experiences, therefore don't be overly surprised if your lone airgun "grows" into a complete battery of airguns. Many start out with the intention of buying only one basic airgun. Later a more powerful magnum type of airgun may fit into your scheme; then later, as you advance with experience, you may find yourself quite involved in some form of airgun competition. A few of the more dedicated shooters will even be advancing to the airgun Olympics, or the National Field Target Championship — perhaps that dedicated shooter might be you!



Airguns are popular enough that promoters from all corners of the United States have setup their own exclusive Airgun Shows. Above, Ingvar Alm displays a selection of airguns at the annual Minneapolis-St. Paul Airgun Show.

CHAPTER TWO

Airgun Propulsion Systems



Cutaway diagram of a FWB 300S, a recoilless spring-piston Match air rifle.
— Photo courtesy of Beeman Precision Airguns.

The modern airgun is unique in many ways. Because airguns generate lower levels of energy (when compared to firearms), they are safer and therefore less dangerous. Airgun safety backstops do not need to be as elaborate or as stout, when compared to actual firearm backstops. Because of the quieter operation of airguns and their limited range, airgun shooting can safely take place in many areas that are prohibited to firearm shooting. Many airgun enthusiasts practice their sport by shooting targets inside their homes, while using various indoor airgun backstops. With more places open to shoot an airgun, one can become much more proficient at shooting in general.

Ardent airgunners group modern airgun propulsion systems into six distinct categories. These six groups are: spring-piston, gas-ram, which is sometimes called a gas-spring (and a close cousin to the spring-piston system), pneumatic, pre-charged pneumatic, carbon dioxide powered systems, and air cartridge powered guns. Each propulsion system has its followers ready to tout the advantages of a chosen system. I tend to think that each system has its merits and its drawbacks, so let's take a closer look at each type.

Because airguns shoot a pellet at relatively low velocity, they have a much slower in-barrel travel time, (over most firearms) and, consequently, they need to be held on target longer, and follow-through becomes much more important. The very short interval of time it takes between the trigger being pulled and the instant the pellet leaves the muzzle is commonly (albeit incorrectly) referred to as "lock-time". This term "lock-time" and the consequences of it are sometimes bantered around between airgunners. Some airgunners think "lock-time" is very important and will opt for the shortest barrel possible. As I mentioned earlier, the airgunners term "lock-time" is technically incorrect, as lock time is officially defined as the total time it takes a trigger and firing mechanism from the release of the trigger until the firing pin strikes the primer. Since airguns have no firing pin, the term lock-time has no real meaning when dealing with airguns¹. When airgunners talk about "lock-time", they are referring to the total time elapsed between trigger release to the time when the pellet leaves the barrel. This time period actually encompasses many different mechanical actions within an airgun.

There is the reaction time of the trigger/sear mechanism, plus the reaction time of the particular power system used. There is also dwell time — the time period in which the propulsion system is acting upon and accelerating the pellet through the bore, not to mention strictly the barrel travel time which may, or may not, (depending upon the power system and length of the barrel), be the same as the dwell time involved. Add all this time together and the sum equals what most airgunners refer to as "lock-time".

Just remember to hold your sights on your target longer than usual and you should shoot just fine. For the record, airguns with the quickest to the slowest "lock-times" would be the pneumatic followed by the gas-ram, while the slowest would be the spring-piston system. Typical values are expressed in milliseconds, which is a thousandth of a second. Average values would be 8.6ms for a pneumatic rifle, 10.5 ms for a gas-ram and 12-15ms for a spring-piston, while a pneumatic pistol is listed at a blazing 3.8ms.

Spring-Piston

The basic spring-piston system encompasses a wide variety of designs. These various designs can be relatively simple and basic, or they can be exquisitely sophisticated and complex. The majority of simple and inexpensive BB guns, which have been marketed for over 110 years, are examples of the low-priced end of spring-piston design. At the other end of this spectrum, we find technical marvels of great design and grand ingenuity. One such marvel of a spring-piston type that comes to mind is the Whiscombe design, which utilizes two converging pistons of equal mass in order to effectively cancel recoil. I seem to be getting ahead of myself here, so let's start at the basic design of the spring-piston airgun.

The spring in spring-piston refers to the rather large coiled spring used to push a piston in an airgun's air chamber. When this spring is compressed, (when you cock the gun) then released by a trigger/sear mechanism, it speedily pushes a fairly heavy piston forward in an air chamber. This piston is designed with a sealing cup or washer (commonly called a piston seal) on its forward surface, and when set in motion by trigger release it very quickly compresses the air in the chamber and, subsequently, propels the pellet

¹ See: *The Encyclopedia of Sporting Firearms*, pg. 199, by David Petzal-Facts on File, Inc. 1991

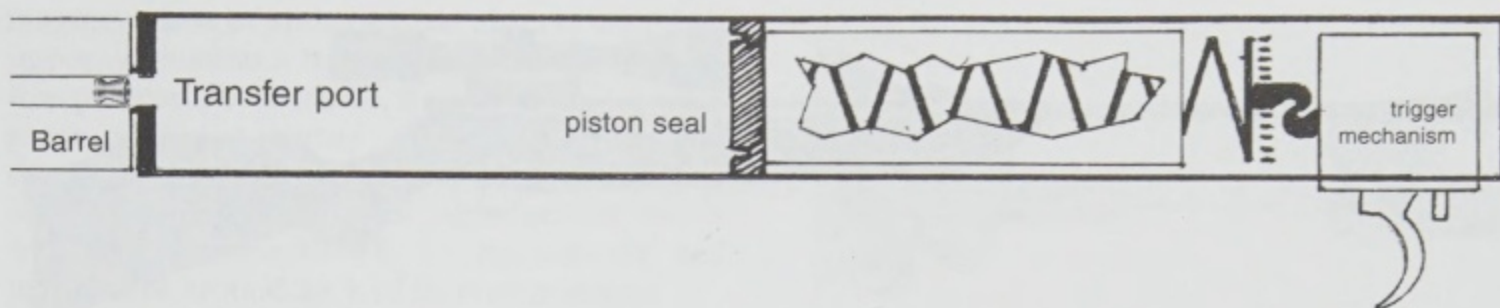


Illustration showing the innards of a spring-piston airgun in the cocked position (mainspring compressed) and a pellet loaded in the barrel. — Illustration by Oscar Davis.

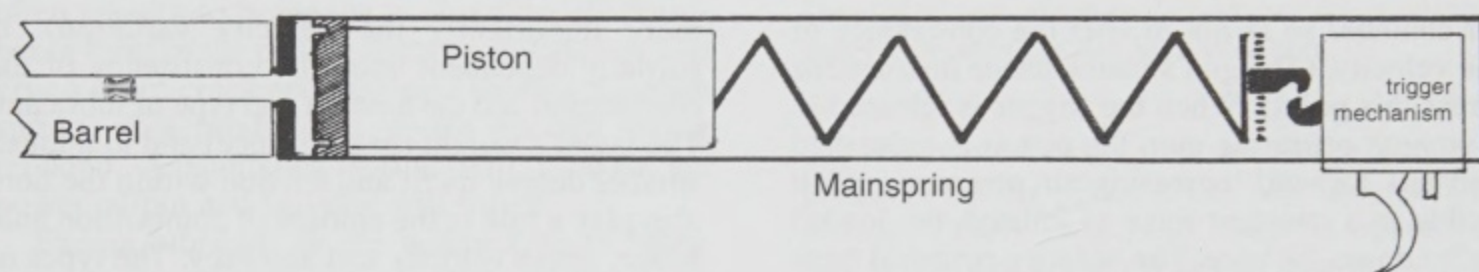


Illustration shows the innards of a spring-piston airgun microseconds after releasing the trigger. Notice that the pellet has started its flight down the barrel, and the piston is near the end of its stroke. — Illustration by Oscar Davis.

(or BB) down the barrel. The above sequence takes place in about 12 to 15 milliseconds. This type of compression is sometimes called "sequence compression".

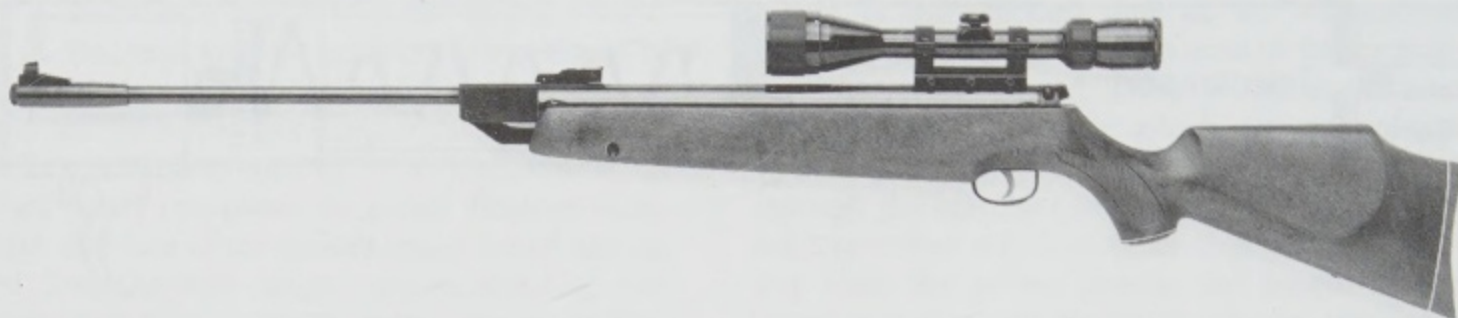
The above process has been neatly condensed to fit into my tidy little paragraph. However, the chain of events is actually quite complex and, when compared to a firearm the number of physical parts involved and the engineering involved in a typical spring-piston machine is amazingly high.

G.V. Cardew and G.M. Cardew collaborated to write a very interesting book, (which I recommend for all airgunners), called *The Airgun from Trigger to Target*. The authors of this book describe the physical processes that lead to the nearly instantaneous air compression involved in the spring-piston system. The authors also described the various operating modes of the spring-piston system and divided them into four distinct operations, which they named: *Blowpipe*, *Popgun*, *Combustion*, and *Detonation*. Depending upon the design and the state of tune, a spring-piston airgun may operate in any one of the above phases, or change from one phase to another. Permit me to very simply abbreviate each operation.

An airgun operating in the "blowpipe" phase

is the most basic and simplest form of an airgun. Perhaps, you owned a simple spring powered BB gun as a kid? You see the blowpipe phase works with a slack fitted projectile (like a BB) and is powered by relatively light air pressure, just like my childhood BB gun. Since the BB (or very loose fitting pellet) lets air pass around it, not much air pressure is allowed to build up and, consequently, the BB darts off down the barrel with relatively low velocity. The modern "Soft Airgun" operates using the basic blowpipe principle. Most soft airguns that are currently marketed mimic the size and looks of real firearms, however, they shoot lightweight 9mm plastic balls. I know several law enforcement officers that shoot soft airguns indoors for practice and recreation. The majority of spring-piston systems do not operate within the blowpipe phase.

The "popgun" phase works with a pellet providing a seal in the breech of the bore (to allow some air pressure to build), but no lubricate is allowed to combust. Many spring-piston guns designed for world-class competition operate in the popgun phase. These high-grade target guns are capable of extremely low velocity variations, as they usually vary only a few feet per second. No lubricate of any kind is allowed to burn in the



The Beeman Kodiak is one example of a very powerful spring-piston magnum air rifle.
— Photo courtesy of Beeman Precision Airguns.

air chamber so as not to alter the consistency of the velocity. (The gun's maintenance instructions stress this point). When the trigger is released in a popgun operating gun, the piston is unleashed and jets forward increasing air pressure until it builds to a constant force to unleash the loaded pellet down the bore. The velocity potential from this system would be considered by modern day standards as below average.

The majority of adult type spring-piston guns operate using the "combustion" phase. As the trigger is released, the piston shoots forward causing a very rapid rise in air temperature amid the rapidly compressing air; this very high temperature causes oil and greases to burn very quickly in a controlled condition. This combustion causes the air pressure to rise even further, and rather quickly it builds up enough force to overcome the pellet's resistance in the breech and drives it down the bore at higher velocity.

The ultimate pellet velocity, (and perhaps

more importantly the velocity variation), is partially dependent upon the consistency of the combustion and the amount and type of lubricant. The pellet's weight (or resistance) and to a much smaller degree its fit and friction within the bore also play a role in the amount of combustion and, hence, affect velocity and accuracy. The types of airguns that operate with this principal are no doubt accurate, but usually less accurate than high-grade spring-piston guns that are designed to operate in the "popgun" phase mentioned previously. The reason for this is chiefly found in the variation of the combustion; because this combustion process has more variables it usually produces a gun whose velocity output will vary more than that of a gun powered by the "popgun" method of propulsion.

However, airguns that operate in the combustion mode usually have increased velocity and energy output and therefore are more useful for longer range work and pest control. The modern



Beeman sells a complete line of airgun maintenance products. — Photo courtesy of Beeman Precision Airguns.

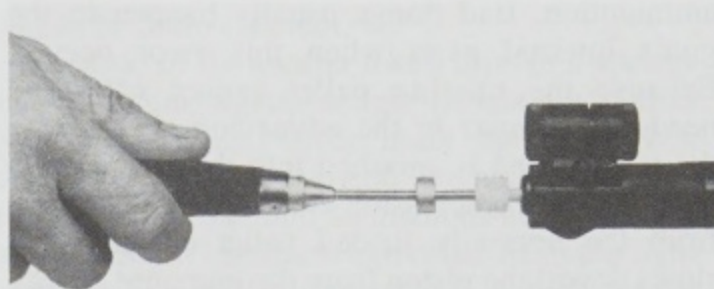


RWS also markets a line of airgun maintenance products, which includes lubricants and felt cleaning pellets.

magnum class of spring-piston airguns would be impossible without this normal type of combustion process. For instance, if no combustion takes place within a spring piston airgun that is designed to work with combustion and produce its normal quick blast of super-heated air, it would lose around 33% of its velocity and upwards of around 55% of its energy output ².

An airgun that operates in a strong *detonation* phase will soon show signs of damage, as this state of tune is definitely not recommended. A detonation in an airgun produces a sharp, somewhat unpredictable, pressure spike, which is often enough to bulge the walls of the air chamber in front of the piston. A strong detonation will give a sharp crack and may also shorten the main spring, if it produces a strong enough spring rebound. A shortened spring will weaken the power output and velocity will suffer.

Excess lubricant or the wrong type of lubricant, in the compression chamber is usually to blame. During actual air compression, the air is super heated to as high as 2,000°f for a fraction of a second. This unique hot-air production from spring-piston guns requires a special high flash point (compression chamber) lubricant. Normally, only a minute amount of this lubricant is actually burned per shot, and any excess may lead to some form of detonation. I understand that different levels of detonation may exist in a spring-piston airgun. Have you ever opened a brand new spring-piston airgun out of the box and discovered that the first three or four dozen shots, (maybe more or less), produced smoke from the end of the muzzle? This condition is commonly called *dieseling*, and is actually a minor form of a detonation process resulting from excess factory lubricants burning in the compression chamber. Sometimes, this dieseling process may last through several hundred shots. When the manufacturer of a spring-piston airgun states that it may take from 1000 to 1500 shots for the gun to break-in and stabilize, you now know the chief reason why — excess lubricants are burning out of the rifle while usually producing rather wide velocity spreads which can easily cause erratic accuracy. During this break-in period, metal parts are also wearing and meshing together, and this is another reason why a particular air gun may be somewhat inaccurate during this time.



Despite some information to the contrary, airguns need periodical barrel cleaning and maintenance. Don't use firearm type solvents, as they may damage an airgun's internal seals. Special airgun cleaner-degreasers are available and recommended for bore cleaning.

I still remember my first shot out of a Chinese produced spring-piston rifle. My long awaited package finally came, and I eagerly opened the box to quickly get at my brand new toy. After a quick read through of the instructions, I commenced to load a pellet and shoot it into a box of phone books. A sharp crack ensued, and then a big puff of smoke came bellowing out of the barrel. While it all seemed amusing at the time, little did I know about the damage the detonation caused inside the gun! You see, that first shot after the loud detonation was the one and only shot the gun was capable of! Yes indeed, my new toy was internally damaged — and damaged enough that it did not function at all afterwards. It was a fluke for sure, but what I had was a one-shot airgun. Luckily, I was able to get a refund on that particular air rifle.

Follow the factory instructions for maintaining your spring-piston airgun. Specialty oils such as Beeman chamber oil #9250, Beeman Airlube #9300 or Beeman Ultra lube #9290 should be used in the compression chamber sparingly. Generally, only two drops of chamber lube should be used every 5,000 rounds or every 8-12 months.

According to Beeman, spring oil should be applied to the mainspring of recoiling spring-piston guns not less than every five or ten tins of pellets, or every six months.

Precautions:

The worst thing you can do to a spring-piston gun is to dry-fire it; that is shooting it without

² See: *The Air Gun from Trigger to Target*, pg. 19- *The Nitrogen Experiment* G.V. Cardew & G.M. Cardew-1995

ammunition. Bad things usually happen to the gun's internal parts when this error occurs. Because the missing pellet cannot offer the needed resistance to the advancing air column, the piston head is smashed into the front of the receiver (or compression tube). This resistance from the normally loaded pellet cushions (or slows down) the piston from the immense energy that the compressed spring releases when you release the trigger.

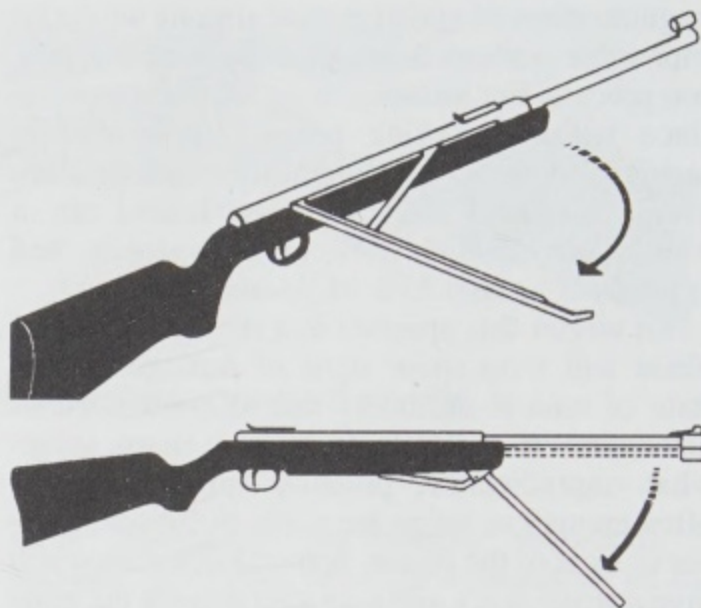
Spring-Piston Cocking Methods

Spring-piston rifles come in all sizes and power levels. They are cocked by one of these methods: breaking the barrel, (break-barrel), side lever, underlever, or top lever.

The break-barrel type is generally considered to be the fastest and most convenient to load. Care must be taken to prevent the barrel from accidentally closing during the cocking procedure. After a barrel is cocked in the downward position, be sure not to accidentally trip the trigger, because on many models this causes the barrel to close rapidly and it may, very painfully, break your hand or a finger; it will most always also crack the stock in the process. Break-barrel types are sometimes considered by some shooters as being inherently less accurate because of the movement of the barrel during cocking, but testing has shown that this is not categorically true because of a myriad of different things that can affect accuracy. If the lockup of the barrel is tight and properly adjusted, I have actually witnessed better accuracy on specific specimens



Cocking and loading a spring-piston powered break-barrel air rifle.



Top: Side-lever Cocking, Bottom: Underlever Cocking. — Illustrations courtesy of Beeman Precision Airguns.

of break-barrels over different types in the same price category. So, you could say that in theory this type may have less inherent accuracy, but many factors *may* easily override this.

Side lever cocking types are sometimes touted as being the best of both worlds, as they cock nearly as fast as a break-barrel type, yet they utilize a fixed barrel. These types usually have some type of anti-bear trap device to keep the lever from unexpectedly closing on the shooter. My RWS models 54, and 48 are examples of powerful side lever cocking air rifles. When I am shooting on the ground prone style, or when shooting from a bench rest with an air rifle, I have personally found the side lever cocking system to usually work out smoother than the other systems. However, when I am shooting in different positions, I personally prefer the other types of cocking systems.

Underlever cocking types have been favored for many years by the majority of top field target shooters. They are generally known to be less sensitive to how they are held and gripped. Towards the end of a big field target match, it is not unusual for shooters to lose a little concentration and, subsequently not quite as much attention is placed upon the holding technique, so a rifle that is more forgiving in this regard has an advantage. Since field target shooters are a pretty picky lot, many of them consider this advantage a real plus, hence the popularity of underlever cocking types.



Field target shooter cocking an underlever air rifle.

Top lever or Overlever cocking. The Beeman P1 spring-piston pistol and the Beeman P3 pneumatic pistol are a few examples that use this type of cocking action. As far as I am aware, no air rifles use an overlever for cocking.

Dwell Time:

Dwell time — the time period in which the propulsion system is acting upon and accelerating the pellet through the bore. Most spring-piston propulsion systems are fairly quick or short, (relative to airguns); they are second in dwell time to only its cousin the gas ram system. Some sources say a barrel length of at least 13" is required for maximum velocity that a spring-piston system can generate. Other sources say that maximum velocity is usually achieved with a barrel of at least 9" in length. (I don't know who is right; it probably depends on the particular power system used and the caliber and may also vary according to the weight of pellet used). When an overly long barrel is used it may actually slow the pellet's velocity, thus from excess friction, since no power source, or accelerating force, is still acting upon the pellet after the pellet has traveled about 13" of barrel. This will change somewhat, depending upon which caliber you are considering, because a larger caliber will have more surface area of the pellet available for the blast of compressed air to accelerate it through the bore. This is one reason the larger calibers are

said to be more efficient.

Because of the shorter dwell time of a spring-piston system, lighter weight pellets are said to be more efficient over most heavy pellets. However, the larger top-end magnum rifles usually shoot the medium to medium-heavy weight pellets best, as harshness can result from too light a pellet. Extremely light pellets in high output rifles don't offer enough weight resistance to cushion the piston effectively. Then again, if you propel an extra-light weight pellet to super-sonic velocities don't expect top accuracy, because the pellet will soon drop to sub-sonic velocities and the resulting shock waves can cause excessive yaw and sometimes violent tumbling.

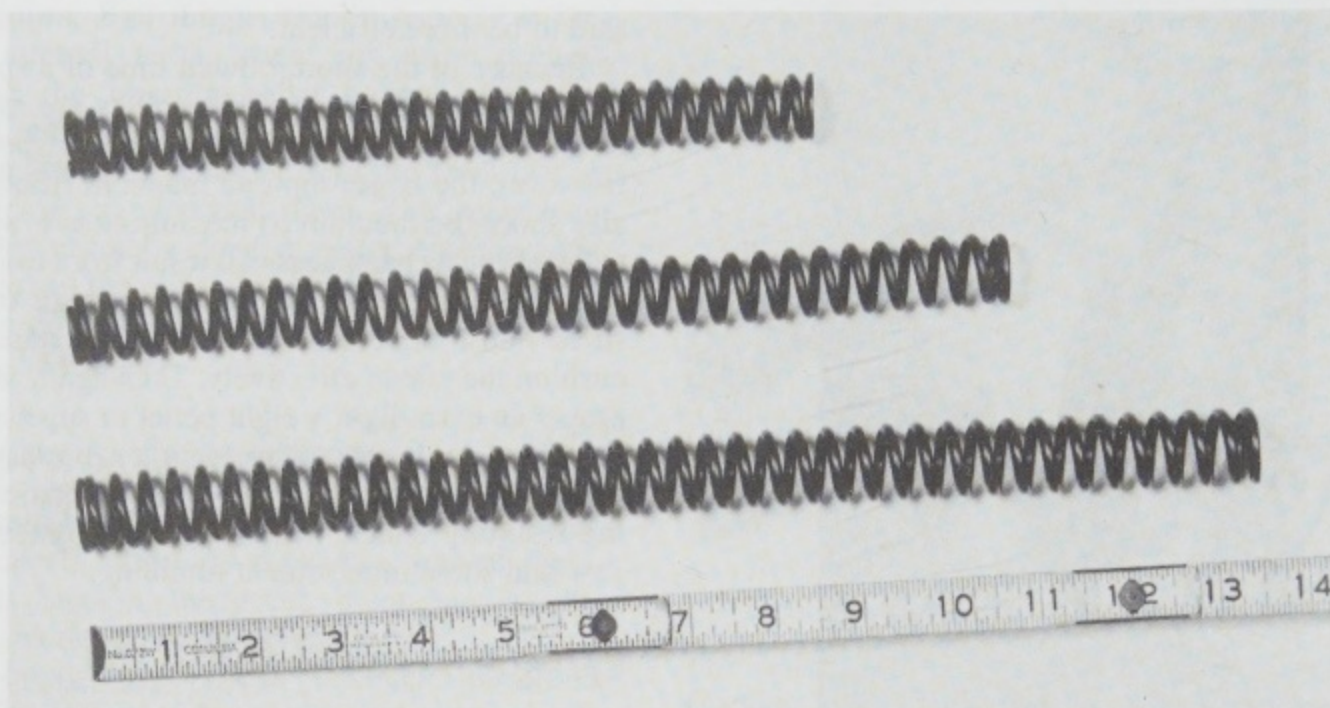
Spring-Piston Evaluation

Pro: Propulsion is self-powered by an internal mainspring, with no need for external sources, and no need for time consuming and noisy hand pumping of compressed air. By virtue of these two reasons alone, the spring-piston system is a favorite among many hunters. Magnum power is readily available on the majority of models with one cock of the mainspring. No troublesome valves or "O" rings to maintain. Noise is almost always less than CO-2 powered guns and less than equivalent powered pneumatic guns — less costly and more trouble free power system than most pre-charged pneumatics.

Good quality light weight and medium weight models are a joy to shoot, as they are very accurate and have a smooth and gentle shot cycle. The aforementioned models I shoot, (Beeman models R7, and R8 and to a lesser extent my old classic FWB 124), are also not prone to being very hold sensitive.

Con: One cannot leave a cocked airgun in the "cocked" mode for extended periods without the possibility of weakening the mainspring. Again, G.V. Cardew & G.M. Cardew, authors of the book *The Airgun from Trigger to Target*, suggest that airgun springs don't lose their *energy storage capacity (ESC)* from age or usage and only lose ESC by becoming shorter in length. (For those interested, Tom Gaylord in his book — *The Beeman R1* conducted another interesting and extensive mainspring failure test. For further reading, I highly recommend Tom Gaylord's book).

Spring guns normally exhibit to some small degree mainspring vibration, recoil and twang or noise. In most cases, the vibration and noise can



The photo above shows a trio of spring-piston airgun mainsprings. Top to bottom: A mainspring from a low-power HW55 MM, spring from an RWS model 54, while the largest spring came from a Beeman Kodiak. The Kodiak is generally regarded as the most powerful air rifle that uses a conventional coiled mainspring.

be subdued or eliminated with an aftermarket tune; while recoil can usually be subdued to a degree, it cannot be entirely eliminated. (Excepting of course, guns that are designed with some type of recoil cancellation or suppression system.)

Spring-piston (and gas-ram) airguns require special scopes that are designed to cope with the quick double-recoil action that spring guns are known for. When considering a scope for a spring gun, it is always wise to check with the scope's importer, or manufacturer, to confirm that the scope is rated for use on spring-piston airguns. A spring-piston gun's double-recoil sequence originates from the spring and piston's quick jump forward, which causes the whole gun to recoil backwards, then as the piston rebounds backwards from the cushion of compressed air at the end of its stroke, it causes the gun to quickly snap forward. Due to this quick recoil action of the mainspring, some guns also require the use of an extra scope-stop to eliminate scope creep and rearward movement. The use of a non-permanent thread locking compound is also recommended to keep the scope and mounts tight.

Most spring-piston guns are hold-sensitive to some degree; that is, they can be less accurate (or change point of impact) with certain tight grips or from gripping the stock too hard on certain parts of the stock, or inconsistent grips. Some

rifles shoot their best only when held lightly on a certain location on the stock. Some experimentation from the shooter will be needed to determine this effect and how prevalent it is in regard to your particular gun. In fact, you may discover certain rifles may not shoot well at all from a typical bench rest setup. Then there are other guns that may shoot well from a bench rest, if rested on a very soft bag near to the trigger guard. Remember to never rest the barrel directly on a bag or permit the barrel to touch anything during the firing cycle.

Generally speaking, the overall weight of magnum-class spring-piston rifles is heavier than the average CO-2 or pneumatic rifle.

Gas-Ram or Gas-Spring

A close cousin to the spring-piston system is the gas-ram, which is also known as a gas-spring. This type of propulsion system was invented by H.F. Taylor and D.R. Theobald, and their first specimens were completed around July of 1982. This system can remain in a cocked status indefinitely without weakening the gas-spring. Airgun hunters are one class of shooters that appreciate this system, because they may leave a rifle cocked for several hours while waiting for their quarry to appear. Advertisements to this effect

are also greatly promoted by the gas-ram people, while to the contrary some spring-piston aficionados think the spring-weakening syndrome is much overstated.

Instead of a powerful mainspring, the gas-ram system uses a pre-compressed volume of sealed nitrogen that, when cocked, further compresses the air and, when released by the trigger/sear unit, it drives a light-weight piston forward that drives a pellet down the bore towards the target. Other than the compressed nitrogen taking the place of a mainspring, a gas-ram gun functions like a typical spring-piston gun. Since the sealed nitrogen inside the gas-ram used by this system is used over and over, or indefinitely, it requires virtually no user maintenance. In fact, the factory instructions caution the shooter against adding chamber lubrication, and if the unit ever requires servicing it is to be "factory" serviced only.

Most Theoben gas ram rifles have the capability to be power adjustable through the means of a

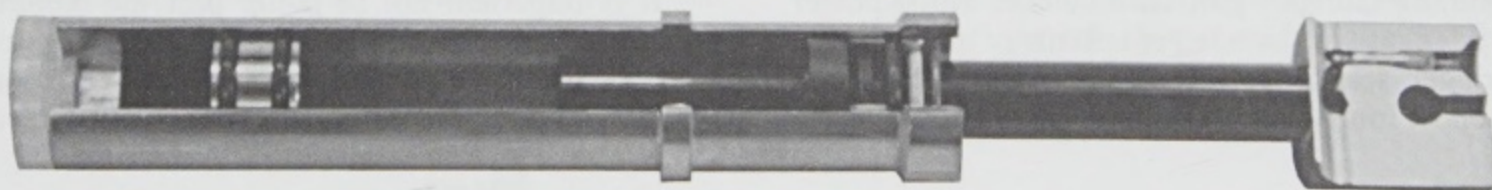
special air pump. A screw at the rear of the action gives access to a Schrader valve, which is used in conjunction with the air pump to vary the charge level of the gas ram unit. In the past, over-charging was a common practice and, subsequently, the rifle suffered from poor accuracy and repeatability. In practice, the hand pump and the ability to vary a Theoben's velocity are rarely mentioned, and this feature seems to be low profile.

The gas-ram system has the advantage of producing a quicker "lock-time", (there's that wording again), or sometimes referred to as have a faster shot cycle. There is one other advantage that comes to mind when I think about a gas-ram air gun, and that is — zero vibration. In a gas-ram system there is no physical spring to "vibrate" or un-twist when unleashing its power, so therefore no vibration. However, new shooters to a gas-ram rifle usually notice and remark about its quicker than usual recoil effect. The upper echelon (power wise) of gas-ram rifles definitely

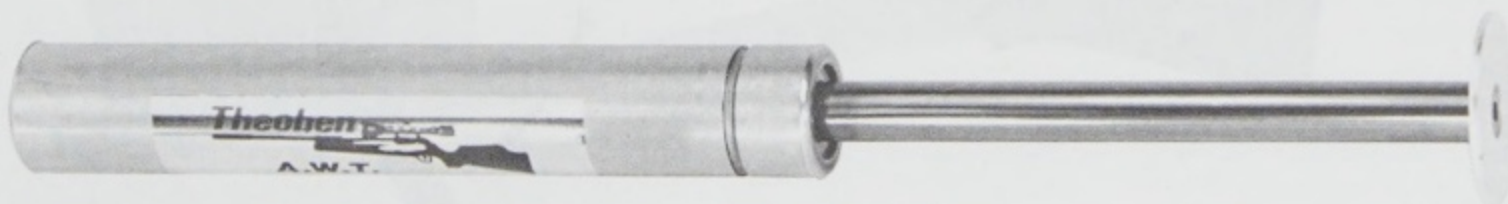


The Beeman Crow Magnum is one example of a gas-ram powered air rifle.

— Photo courtesy of Beeman Precision Airguns.



Cutaway view of a Theoben gas-spring unit. — Photo courtesy of Theoben engineering.



After-market gas struts (gas springs) are available from Theoben Engineering. These units fit many spring-piston rifles and replace the mainspring. — Photo courtesy of Theoben Engineering.

produce a quick and sharp recoil effect, just ask any Beeman Crow Magnum owner. This quicker shot cycle can also be abusive to an air rifle scope, and Theoben Engineering is marketing their Dampa scope mount which cushions the shock effect to the scope. My own personal Beeman SLR 98 exhibits a more subdued recoil and, of course, there is no vibration whatsoever.

Remember, for the best accuracy some experimentation with different grips may be required before you discover how your gas-ram rifle likes to be held, because they can sometimes be sensitive to the way they are held.

Also remember when you cock a gas-ram gun to be prepared to put out a little more effort, perhaps 20% more, as compared to an equivalent powered spring-piston gun. Also because a mainspring will stack towards the end of its compression, it feels harder to cock near the end of its stroke, but not so with a gas-ram gun, because, of course there is no physical spring, and the cocking effort remains consistent throughout its stroke.

Pneumatic Powered Airguns

Pneumatic powered guns are powered by pre-compressed ambient air. These types of airguns are considered recoilless, because there is no internal mechanism like a mainspring uncoiling to cause the gun to move or to vibrate. Pneumatic airguns are also known for not being hold-sensitive, which is a major reason most top field target shooters are able to achieve a higher percentage of hits. There are three types of pneumatic airguns which are discussed in more detail below.

Compared to a spring, or gas-ram powered gun, a pneumatic gun has a quicker acting power system as well as a larger volume of air. Once the trigger sear is released, the compressed air is almost immediately pushing the pellet down the

bore; no time is wasted waiting for a spring to build-up the compressed air. Another plus — because a pneumatic powered gun normally releases a larger volume of compressed air, heavier pellets are more efficient.

Multi-stroke Pneumatic

Often referred to as pump-up guns, the modern multi-stroke pump gun has introduced many youths to the joys of airgun shooting. With a multi-stroke gun, the fore-end forms a handle, and when pumped, the gun's internal mechanism compresses and contains a certain amount of air with each stroke. After a shot is propelled down the bore you must, of course, re-pump the gun to re-charge the reservoir for the next shot. Multi-stroke guns have a minimum and a maximum number of strokes that are required for propulsion. A multi-stroke's pump-up range of strokes should be listed in the gun's instruction manual.

Two basic types of valves are used in multi-stroke guns: the knock-open, and the blow-off. The knock-open valve requires a separate cocking action before the gun will shoot. However, the trigger pull remains constant, regardless of the number of pumps. The knock-open type works via a spring loaded striker that quickly opens and shuts a valve, which releases the quick burst of compressed air for propulsion. With the blow-off type of valve, the trigger is directly connected to the air release valve, and the trigger pull becomes increasingly harder, commensurate with the number of pumps instilled into the gun. However, the blow-off system requires no separate cocking action for the gun to shoot.

It is important not to pump past the recommended limit, because doing so imparts extra strain on many parts and seals, which will soon fail if over-pumping is rampant. Many uninformed



Swinging arm type of multi-stroke pneumatic.



Above, a Daystate Sportsman MKII Deluxe multi-stroke pneumatic is perhaps the ultimate portrayal of a modern day pump gun.

— Photo courtesy of Airguns of Arizona.

users of multi-strokes routinely over pump their guns with the erroneous belief that it gives them significantly more power. The truth of the matter is that most of the time over pumping a gun results in very little, if any, extra velocity and is actually counterproductive. A simple rule of thumb with multi-stroke pneumatics — the more you over pump, the quicker the gun will need repairs.

Multi-stroke aficionados are able to pump their guns to a level that best suits the type of shooting planned, from low-powered plinking to moderately high-powered hunting applications. The multi-stroke shooter must however remember that variable amounts of pumping will result in variable trajectories along with a moving zero.

When I shoot one of my multi-stroke guns for ease of remembering my variable pellets' impact, I memorize a pre-set threesome of pumps. For example, when shooting my old Sheridan Silver

Streak I use three pumps for indoor plinking, five pumps for normal outdoor shooting, and occasionally seven pumps as my maximum. For each pump level I have a commensurate zero at a predetermined range.

After all the shooting is done for the day, remember to pump your multi-stroke gun once (but of course don't load a pellet) and store your gun this way to help preserve the seals.

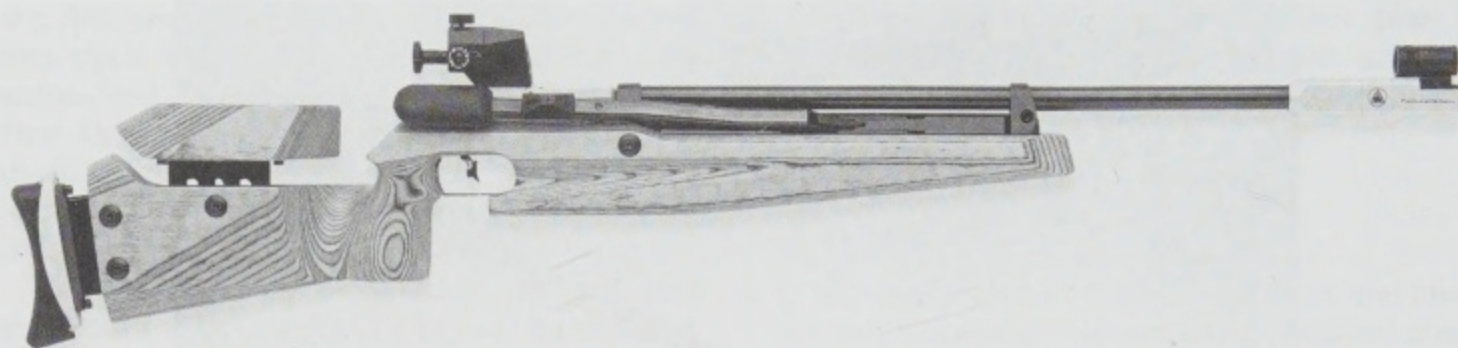
Single-stroke Pneumatic

A single stroke pneumatic works like a multi-pump pneumatic, with the exception that only one pump delivers the set amount of power built into the particular gun. The energy output is usually on the low side, because one pump limits the amount of power that can be comfortably



The Daisy model 753 represents an entry level single-stroke pneumatic 10-meter target rifle.

— Photo courtesy of Daisy Mfg. Co.



Above, a Beeman/FWB 603 represents an Olympic-level single-stroke pneumatic 10-meter target rifle.
 — Photo courtesy of Beeman Precision Airguns.



Russ Haydon (of Russ Haydon's Shooters' Supply), is caught practicing with his FWB 600 single-stroke pneumatic. In 1986 Russ set a new NRA National record with his FWB 600 air rifle, which happens to be the forerunner to the current model FWB 603.

attained without undue pumping effort. Ten meter target rifles and pistols use this system to their advantage, because one pump is about optimum for ten meter shooting.

Con: Cocking effort is noticeably greater; for instance the world-class Beeman/FWB 603 single-stroke pneumatic target rifle requires 19 pounds of cocking effort, versus the spring-piston Beeman/FWB 300S that requires only 9 pounds of effort. Seals and "O" rings can leak at the most inopportune times. Two of my shooting friends, on separate occasions, recently brought out their seldom-shot single-stroke target rifles

with the intention of displaying their fine accuracy. However, as it turned out both rifles failed to hold a compressed charge, because the seals had failed.

Pre-Charged Pneumatic/PCP

For the veteran airgunner, pre-charged pneumatic guns seem to capture a lot of attention these days. The pre-charged variety utilize a fixed or detachable air reservoir for compressed air that is charged, or filled, from an outside source, such as an air compressor, or high-pressure hand pump, or a scuba tank.

The modern PCP gun holds the distinction of being recoilless, accurate, powerful, and easy to shoot. Besides field target shooters, some airgun hunters find favor with high power pre-charged rifles. Pre-charged models that provide muzzle energies from around 30 foot pounds to 50 foot pounds are available in .22 caliber as well as .25 caliber. As mentioned before, RWS markets a 9mm Career model that will even exceed these energy levels.

The large bore aficionado should find favor with either a Quakenbush or a Barnes pre-charged pneumatic. These big bore guns start at .375 caliber and run the gamut up to .56 caliber and develop muzzle energies that top out at around 600 foot pounds.

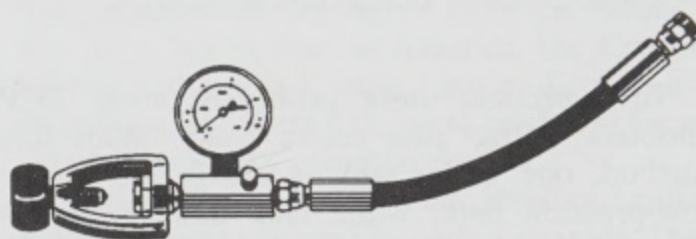
Pre-charged guns, depending upon the particular gun and the size of the air reservoir, may give anywhere from around 10 to perhaps 100 or more fairly consistent shots before air pressure falls too low and pellet velocity takes a nosedive. Some pre-charged guns are adjustable for power output, such as the Beeman Super 12 and many of the RWS Career models.

The negatives of shooting a PCP gun include increased shooting noise, however the increased decibel level is not that noticeable unless the gun is putting out more than about 20-25 foot pounds of energy. With no warning, or precursor, internal seals and valves can fail and will require periodical maintenance. Some shooters are also hesitant to go the PCP route because they require a separate charging device and all the associated equipment that goes with it.

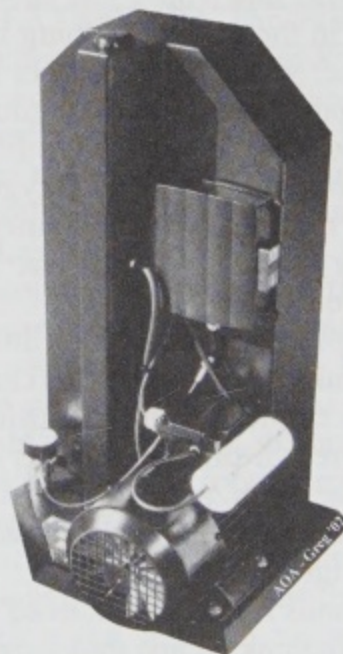
As mentioned before, pre-charged guns are filled from either a special high pressure air compressor, a hand pump, which is quite a bit of work, or from a scuba tank. Most PCP shooters end up using the scuba tank method. The majority of PCP guns operate from a safe working maximum pressure of 3000 PSI (pounds per square inch gauge). Three thousand PSI is also the full pressure of the typical scuba tank. What this means is that after a couple of fills from one full scuba tank, the tank will not be capable of filling the gun completely again and the shooter will not get the maximum amount of shots that his gun is capable of. Another aggravation with filling PCP guns from one scuba tank is that once the tank is drained to a certain pressure level (perhaps half a tank) it becomes too low to fill a gun and is rendered useless.



Filling a pre-charged pneumatic rifle with air from a scuba tank.



Scuba hose adapter for charging pre-charged pneumatics. D-ring at left clamps to scuba tank. — Illustration courtesy of Beeman Precision Airguns.



One method of charging a pre-charged pneumatic is through the use of the EZ-Air Compressor made by FX Airguns. — Photo courtesy of Airguns of Arizona.



A Daystate CR97 is one example of a popular pre-charged pneumatic air rifle.

— Photo courtesy of Airguns of Arizona.

To overcome these problems, some PCP shooters utilize two scuba tanks. With this method, one scuba tank is designated as the low-pressure tank, while tank number two is designated high-pressure; respectively the bulk of a fill comes out of the low-pressure tank, while the high-pressure tank is reserved for the final gun top-off to 3000 PSI. This method allows the shooter the luxury of maintaining his gun at a higher pressure level without making as many runs to the dive shop for refills.

The number one safety rule when filling a PCP gun with air is that you must never use pure oxygen, because this would just about guarantee an explosion in the process! Going back to high school science, you may remember that oxygen is only nominally present in our atmosphere with a 21% volume and the bulk of our breathable air comes from nitrogen at 78%. Oxygen becomes an explosive mixture when it comes in contact with most any form of oil, and there is sure to be oil somewhere in your gun!

Caution should be used when filling PCP guns from scuba tanks because fast fills can cause heat which in turn can lead to an explosion danger if any typical firearm oils or solvents are present. Silicon grease, such as Dow 111, is the dive industry's recommended lubricant, which should be used sparingly.

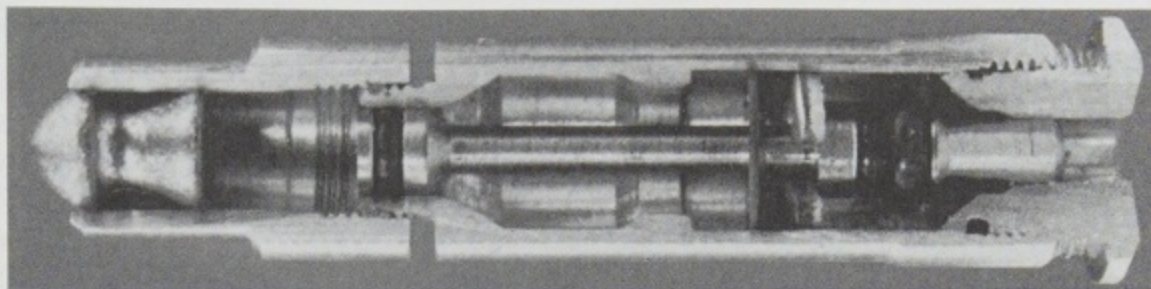
SCUBA stands for Self Contained Underwater Breathing Apparatus. Scuba tanks are required to be visually inspected at least once a year. Most dive shops have personnel that can perform this inspection, which consists of a look inside and outside the tank for any signs of corrosion, or cracking that could lead to a failure of the tank. Scuba tanks must also undergo a hydrostat test

every five years by a certified facility. After testing, dated and signed stickers are attached to the tank that confirm the tank's serviceability. A scuba tank that is fully charged to 3000 PSI holds enormous energy potential. The kinetic energy contained in a fully charged tank can be as high as 1.3 million foot-pounds!! This amount of energy is said to be enough to lift a 100 ton diesel locomotive off its tracks and into the air! If a charged tank is dropped and the valve is broken off in the process it will propel the tank like a missile capable of penetrating solid concrete walls. Remember to always use caution when handling scuba tanks.

To compensate for a pre-charged gun's tendency to deliver reduced velocity, while the gun is being shot and the compressed pressure of air is accordingly being reduced, a factory or after-market regulator is commonly used. A regulator is a mechanical device that controls the airflow, using a firing valve, a firing valve chamber, and a small reservoir.

Regulators improve the shot to shot consistency and usually extend the amount of shots per fill. The down side is that regulators depend heavily on rubber O-rings, and over time these O-rings tend to dry out and crack, which causes air leaks. Regulator O-rings are also subject to wear, as they constantly wear against the walls of the regulator body. It is just a matter of time before a regulator will need to be serviced.

The game of field target has made an opportunity for the regulator specialist to show off his goods, which is another reason why The "A" Team and Joe Korick have been so busy. See the appendix for contact information.



A cutaway view of a Brocock air cartridge. — Photo courtesy of Airguns of Arizona.

Air Cartridge

During the mid-1980s, a British firm called Saxby-Palmer was the first to market an Air Cartridge system. Since then, the British firm Brocock has fine tuned the air cartridge system, which it calls the Tandem Air Cartridge (TAC) and the Micro Air Cartridge, which are pre-charged miniature cartridges. These systems are not common in the States yet, but they sound interesting and just might catch on and become popular in the future.

These air cartridges look somewhat like a high-tech firearm cartridge, only with a pellet loaded in place of a bullet. These cartridges are filled with compressed air from a diver's bottle or a hand pump, and the shooter has a choice of power levels, — low power for plinking or high power for some short range hunting applications.

Brocock's cartridges are popular in England with Wild West enthusiasts, who shoot these cartridges from replica guns.

Carbon Dioxide Gas/CO₂

Towards the end of the nineteenth century, a French inventor by the name of Paul Giffard

patented his lavishly produced interchangeable gas cylinder carbon dioxide guns. Giffard's guns were considered expensive and, unfortunately, the common shooter didn't have the means to own one. Much later in America, the Crosman Corporation started using carbon dioxide as a propellant, and these guns were marketed for and gobbled up by the common shooter.

During the 1930's, Crosman developed gallery guns that were operated by carbon dioxide. These guns were fed through hoses that were connected to a large central supply tank of carbon dioxide. Later, Crosman produced self contained carbon dioxide rifles called "CG" guns, which used four ounce refillable tanks. However, none of these guns gained wide acceptance by the shooting public.

Wide shooter popularity and acceptance of carbon dioxide guns didn't start until 1954-1955 (respectively), when the Crosman Corporation came out with its new CO₂ Powerlet (now sometimes called a 12 gram cartridge) and the dual CO₂ powered model 160 single shot .22 caliber rifle. Later, many different models and brands became popular with the suburban shooter.

In England, carbon dioxide powered guns were for many years considered firearms, and to own one you needed a Fire Arms Certification. However, just recently England has relaxed its laws about carbon dioxide guns, and they are legal without a FAC, that is, as long as the energy level doesn't exceed 12 foot pounds.

Our atmosphere normally contains a small amount of carbon dioxide (about 0.03 percent). Carbon dioxide has different properties than air, one being that it is 1.5 times as dense and is considered to be a "sticky" gas that does not flow as readily as air. Carbon dioxide is also sensitive to temperatures and changes its form from a liquid state to a gas with a rise in temperature. As temperatures rise the pressure also rises inside a carbon dioxide container. At normal room



Carbon dioxide cartridges or cylinders are available from a wide variety of stores, and sporting goods catalogs. — Photo courtesy of Beeman Precision Airguns.



Alan Hanson enjoys shooting the authors vintage Crosman 160 CO₂ - powered air rifle.



The Gamo R-77 Laser, top, and the Smith & Wesson model 586 (produced by Umarex) are examples of CO₂ powered guns that feature repeating mechanisms. — Photos courtesy of the respective manufacturers.

temperatures the pressure inside a 12 gram cartridge is typically about 1,000 pounds per square inch.

When a pellet is shot from a CO₂ gun, a small amount of the vapor is released and the pressure inside the cartridge falls, which causes some of the liquid part to boil off to replace the pressure. However, this process needs heat to work, which it captures from within the liquid CO₂ and its container, but in doing so it reduces its temperature, and subsequently, this results in a temporary drop in pressure until it can be restored by capturing ambient heat from the atmosphere. This is the reason velocity will decline when you shoot a CO₂ gun rapidly, and the reason they operate with less efficiency in cold climates. I usually consider a temperature of around 50°f as minimum, and I much prefer to shoot my CO₂ guns in temperatures from 70°f to 90°f.

One advantage from CO₂ guns is that a good number of shots can be obtained from a small volume of liquid. Another advantage is the ease of which a gun can be cocked, as no spring is compressed, nor is air being compressed. It is also easier to incorporate repeating mechanisms in CO₂ guns versus other power systems, and carbon dioxide guns are usually lighter in weight.

With most CO₂ guns it is not a good idea to leave a partially charged cartridge in the gun, as it can be hard on the seals (check your owner's manual for specifics). However, leaving partially used, or new CO₂ cartridges in one of the discontinued Crosman models 160/167/180/187/400 is perfectly fine and was a recommended practice to keep out impurities and dirt.

Air Capsule

Airgun makers Brocock and Ultiforce developed this system to replace the CO₂ gas cartridge with a refillable capsule that works off compressed air. The Air Capsule was designed to operate at the reduced pressure level that CO₂ guns are designed for. The Air Capsule is said to give around 20 shots with slightly more power and consistency than regular CO₂ cartridges.

This system is also made for refills, so when your Air Capsule is empty you simply refill it with compressed air. Another plus — this system is not plagued by temperature changes, or a fast rate of fire either. Since this system is so new, it is hard to predict if it will catch on here in the States, but it seems to have developed a bit of a following in England.

Pellets and lubrication

The type of powerplant you are shooting largely determines if pellet lubrication will benefit you. Airgunners shooting pre-charged pneumatics probably benefit the most from pellet lubrication. You see, compressed air from a PCP type of gun is very dry, or should be, or you will have corrosion problems down the road. This dry air, combined with moderate velocity, can promote leading of the bore which, in turn, can cause accuracy problems. Pellet lubrication helps to prevent this leading problem and may also promote improved accuracy, because the lube protects the pellet during the flight through the barrel. The chief reason for improved accuracy from lubricated pellets stems from less pellet deformation.

You see, when a pellet is accelerated through a rifled barrel it actually goes through somewhat of a swaging process, and a correctly lubed pellet is subjected to less stress and less deformation than a non lubed pellet. The amount of pellet deformation is dependent upon several factors which include, the barrel's internal dimensions, the amount of choke, the type of rifling, the size of the lands, and the internal surface quality of the bore. Less pellet deformation helps to improve

upon ballistic coefficient (a subject that is covered in the next chapter) and downrange pellet stability. Lubricating pellets also helps to thwart barrel corrosion.

Multi-pump pneumatics and CO₂ guns also benefit from lubricated pellets for much the same reasons as a PCP gun does. The leading problem with multi-pumps and CO₂ guns is usually not as severe, because muzzle velocity is generally not as high. Remember that a carbon dioxide powered gun is essentially fueled by a refrigerant, and this refrigerant can easily promote rust and barrel corrosion because of condensation, and lubed pellets help to protect a barrel against condensation.

A spring or piston powered gun normally does not need any type of pellet lubrication. In fact, lubricated pellets can easily cause excessive dieseling in a spring-piston powered gun. Remember that a piston-powered gun puts out a very brief blast of hot air (this hot air reaches temperatures up to around 2000°f), and this hot air can cause the pellet lubricant to burn or diesel, if not applied correctly. In fact, I have heard reports that a detonation is possible, if enough lubricate is exposed to the hot blast of air from a piston-powered gun.

However, some high power spring gun and gas ram gun shooters find that various pellet lubricants are beneficial, if applied carefully. Just remember to use the lubricant very sparingly, and try not to lube inside the pellet's skirt or on the base.

Many Airgunners have found favor with a lubricant called FP-10, by Shooters Choice. Slick Fifty markets another popular lube called One Lube. I have also heard many good reports about a new lubricant called Krytech by Finish Line. Mac-1 Airgun sells Krytech, and it can also be found in many bicycle shops. John Whiscombe recommends lubricating pellets with a mixture of 50% STP engine oil treatment and 50% Hoppes number 9 lubricating oil for use in his air rifles. Other lubricants may also work well, just make sure that you clean your barrel before experimenting with a different pellet lube.

CHAPTER 3

Airgun *Pellets, Testing and Ballistics*



— Photos courtesy of Beeman Precision Airguns.

Airgun Pellets

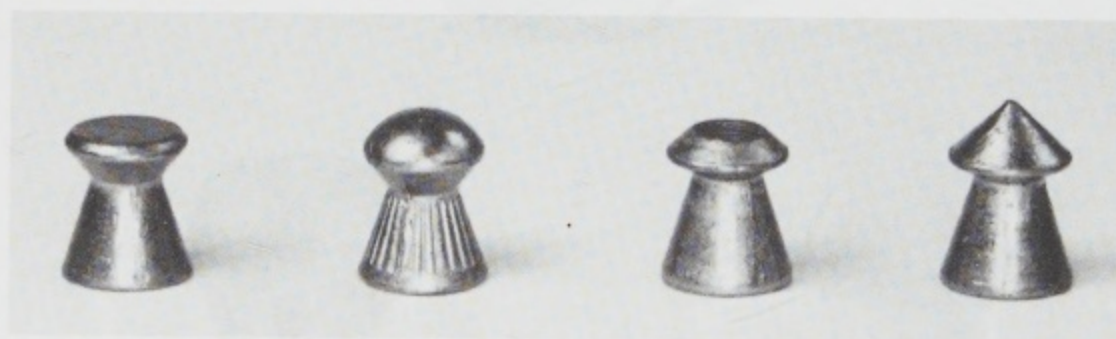
Practically all modern pellets are made of a lead alloy and have what is called a diabolo shape. The diabolo shape resembles an "hour-glass" and the name diabolo dates back to the ancient game of Diabolo, which used a "puck," of sorts, that was shaped like an hourglass. Almost all the pellet's weight is concentrated in the head of the pellet, which gives it extra stability in flight.

The head of a pellet needs to engage the rifling just enough to give it optimum stability and accuracy, without distorting it. The thin flaring skirt at the rear of a pellet should fully engage the rifling of the barrel and seal the barrel for more efficient propulsion. Typically, skirt diameters are several thousandths of an inch larger than pellet head diameters. The flared skirt of a pellet causes considerable aerodynamic drag, which actually serves two purposes. First, it rapidly slows down the pellet's flight speed, which is one reason why airguns and pellets are safer than firearms and bullets. Second, it helps to keep the nose of the pellet pointed forward to the path of its ballistic curve, which increases stability.

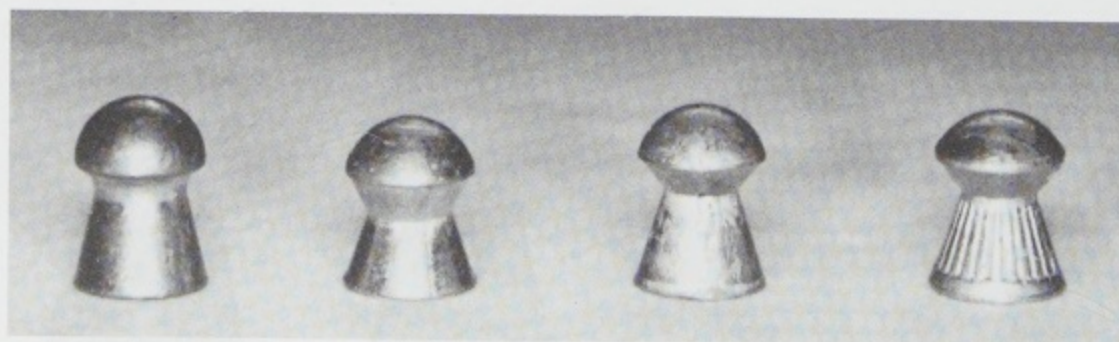
Modern pellets are classified by one of four head designs. The four classifications are **Wadcutter**, **Round Nose**, **Hollow Point**, and **Pointed**.

Wadcutters have a flat head and are designed to cut nice clean round holes in paper targets. Wadcutters are usually the first choice for paper target shooters. Ten-meter shooters and most BRV competitors find favor with the wadcutter design for extreme accuracy. Many short-range pest shooters also find the wadcutter design works well for dispatching various critters. Wadcutters typically limit penetration and may expand to moderate levels, when shot from a high velocity airgun. However, wadcutters are also typically the most aerodynamically inefficient and are not the best choice for longer range shooting.

Round nose pellets are perhaps the most commonly used pellets on the market today. Round nose pellets typically show the best aerodynamic properties. Long range and field target shooters flock to the round nose design because they usually exhibit fine accuracy, show the flattest trajectory, and buck the wind the best. The Crosman



Above, the four basic types of airgun pellets are represented by an RWS pellet sampler. Left to Right: Wadcutter, (RWS Meisterkugeln), Round Nose, (RWS SuperDome), Hollow Point, (RWS Super-H-Point), and Pointed, (RWS SuperPoint).



Popular round nose pellets L to R: Crosman Premier, Beeman Field Target Specials, Air Arms Diabolo Field Pellet, and the RWS SuperDome.

Premier is one of the most popular round nose pellets on the market. The Crosman Premier, along with the Beeman Kodiak, are the top two pellets among field target shooters. Other fine round nose pellets worth testing are the Beeman Field Target Special, the Air Arms Diabolo Field pellet, and the RWS Superdome.

I've had good luck with both the .20 caliber and .22 caliber Crosman Premier for long-range hunting, even when pushed to distances of around 100 yards from a high power air rifle. The Premier is a stout pellet and typically does not expand much, however its accuracy is very often second to none.

For testing purposes and velocity comparisons between airguns, the Crosman Premier has become my "default" or standard pellet. While the Premier pellet seems to lack quick and easy expansion, (which helps when shooting critters), it usually makes up for this deficiency with superior long-range accuracy and stability. I, like many airgunners, am still waiting for a .25 caliber Crosman Premier and additional weight varieties in .20 and .22 caliber.

Hollow point pellets are often recommended as the best for dispatching various critters out to moderate ranges. Beeman has two hollow point designs, the Silver Bear and the awesome Crow



.177 caliber pointed pellets L to R: RWS SuperPoint, Gamo Magnum, & Beeman Silver Jet.

Magnum. The Crow magnum hollow point is highly regarded by many airgun critter shooters, because this design really expands, which results in additional shock effect. The RWS Super H point is another effective hollow point design that shoots well in many air rifles.

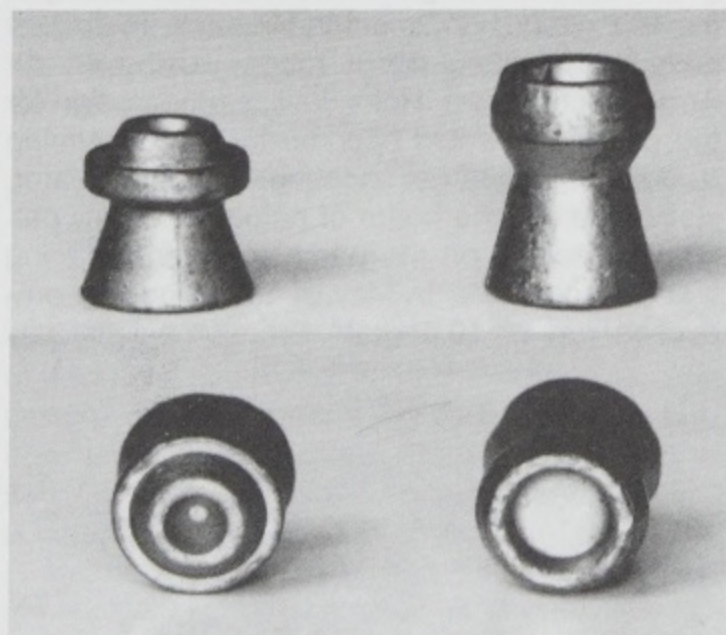
Pointed pellets are made for shooters who like downrange penetration over expansion. Crow and pigeon shooters sometimes prefer this design, because of its penetrating qualities. Crows are especially noted for possessing tough chest feathers, and good penetrating pellets are helpful for quickly dispatching the wily crow. Somewhat surprisingly, the pointed design usually plays second fiddle to the better designed round nose pellets, when it comes to downrange aerodynamics. Many years ago, I shot pointed pellets on a regular basis, however more recent testing proved pointed pellets are not as accurate in most of my airguns as other designs. Please don't permit my personal luck with pointed pellets to lessen your desire to try them, because they just might prove to be very accurate in your airgun.

The Story of the Crosman Premier

Premier Precision

By Kathy Balbierer - Marketing Manager for the Crosman Corporation

"The story of Crosman Corporation's Premier Pellets is the combination of an innovative manufacturing process, a company's dedication to exacting tolerances and one man's love of ballistics. The production and sale of pellets has been the foundation of the Crosman business since the beginning, but the methods of producing the pellets remained the same from 1925 all the way to the mid-1980's. The process that was used involved passing a lead ball, later converted to a lead coil, through a die and then through two



Beeman hollow point pellets Top to Bottom and L to R: Silver Bear, & Crow Magnum.

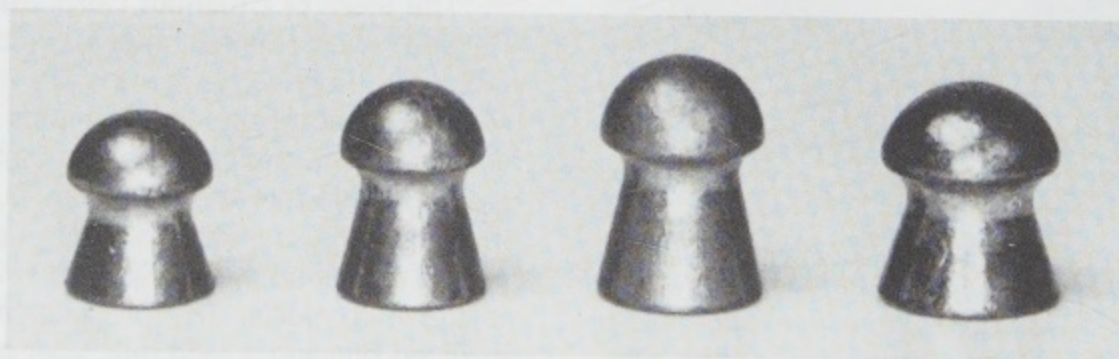
Generally the Silver Bear is recommended for low to medium velocity airguns, while the Crow Magnum is more effective with high velocity airguns.

metal shaping plates. While the pellets made in the 20's were of good quality, the natural wear and tear on the machinery led to a consistent degradation in the quality of Crosman ammunition. By the 1970's, the pellets produced by the worn machinery were well below Crosman's demands for future excellence. Crosman knew about the deterioration of the quality of their pellets, but there was little they could do. There was no company making new pellet manufacturing machinery at the time, because the precision forming of lead, aside from the ammunition industry, was not a common industrial process. All they could do at the time was retool the existing equipment, which would cost large amounts of capital and just delay the problem for a few more years. That was until 1984, when a major ammunition company developed new high-tech machinery for forming lead. Crosman embraced the new technology and spent the next two years, and millions of dollars, developing a new way to manufacture pellets. The patented process that resulted has two basic steps.

The first step of the process involved producing small lead balls of very precise weight. These balls were then used in the pellet machine, which operated along the same principles as plastic injection molding. The pre-formed ball of lead was rammed into the mold cavity, which occurred so fast the lead actually flowed into the die. The die then split and dropped the finished pellet. The extreme precision of this process depended heavily on the exact size of the preform. Too large, the mold would jam, too small and voids would result. Getting the preforms to exactly the same size proved to be difficult, but the engineers at Crosman eventually constructed a process capable of producing 5.3 million pellets a day, with extreme consistency. Consistency in ammunition, between batches and between shots, is

one of the most important aspects of precision shooting. Even the tiniest imperfections in the pellet will translate to inches off the target, or misses in the field. Because each Crosman pellet was produced individually, using dies made from heat-treated wear-resistant metal, every pellet was virtually identical, and with each die created by computer controlled machines, they always would be. At first, the new pellets were only available in a 7.9 grain wadcutter design, but the process allowed Crosman to produce many different designs simply by adding new dies. This allowed Crosman to introduce "Special Purpose" pellets in pointed and domed shapes. Not long after they were introduced, these domed pellets were used to win a field target competition in California. When news of this victory using Crosman pellets reached the factory, the senior engineer responsible for developing the new equipment, Robert Holtz, was overjoyed. He had designed the pellet and, as a firearms enthusiast and shooter, he understood the need of precision shooters for pellet consistency, so he took it upon himself to design a special pellet for the serious field target shooter.

After talking with competitors and following results in airgun publications, Holtz decided that a 10.5 grain pellet, that was as accurate and consistent as the current 7.9 grain domed pellet, would dominate the field target world. Given the go-ahead, Holtz began the design and testing of the 10.5 grain .177 Crosman Magnum. Testing on both indoor and outdoor ranges, using an Air Arms machine rest, Holtz finalized the design for the pellet that would become the overwhelming favorite for field target shooting. Being its creator, Holtz received the honor of naming the new pellet. He decided on the name Premier, meaning first in importance. In May of 1991, the first production run of 10.5 grain Premier pellets was



The family of Crosman Premier domed pellets L to R: .177 caliber 7.9 grain, .177 caliber 10.5 grain, .20 caliber 14.3 grain, and .22 caliber 14.3 grain.



The airgunner's basic five calibers L to R: .177 caliber, (10.5 grain Crosman Premier), .20 caliber (12.2 grain Beeman Field Target Specials), .22 caliber (5.6mm-14.5 grain Eley Wasp, which works especially well in slightly over-sized bores), .25 caliber, (21 grain Diana Magnum), and 9mm (58 grain Dae Sung).

used by Rodney Boyce, a friend of Holtz's involved in the testing, to win the Class "A" Open at the U.S. Nationals. Since then, the dominance of Premier Pellets has been nothing short of complete. Since their release, Premier Pellets have achieved the most wins in major national and international field target shooting competitions, including the 1998, 1999, and 2000 World Championships.

Now available in .177 caliber 7.9gr. and 10.5gr., .20 caliber and .22 caliber in 14.3 gr. Field Target and Match Grade varieties, Crosman Premier Pellets are still made with a single set of tools on one machine. Each batch is still stamped with the die number and the date of production for ultimate consistency."

Common Airgun Calibers

Currently, the airgunner has five basic calibers to choose from. The top five are: .177 (or 4.5MM), .20 (or 5MM), .22 (or 5.5mm), .25 (or 6.3mm) and newcomer 9mm. In addition, several custom air rifle makers produce powerful big-bore pre-charged models. Dennis Quackenbush and Gary Barnes come to mind as two such accomplished custom large-bore air rifle makers.

Dennis currently produces air rifles in .375, .44, and .50 caliber, Dennis produces his guns in batches, which means you should get your order in ahead of time, if you find yourself enamored with one of his models.

Gary Barnes builds custom made pre-charged pneumatics that span the gamut from .25 to .56 caliber, with muzzle energies that top out at

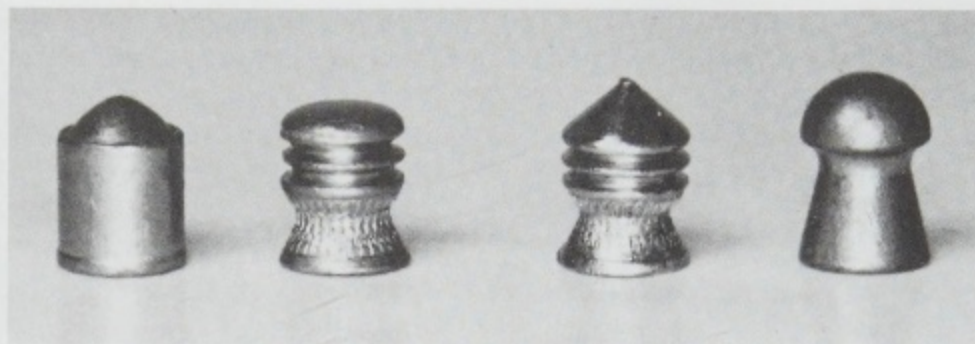
around 600 ft. lbs. Gary will also build you a custom field target rifle, if you so desire, but you better get your order in ahead of time, because typically Gary has many months worth of orders in front of him.

.177 Caliber

.177 is of course the caliber of choice for the serious target shooter. As far as I know, world-class ten-meter target rifles are only produced in .177 caliber. BRV shooters almost exclusively choose to shoot .177 caliber. Most field target shooters also choose the .177 caliber. By far, the largest selections of Match grade pellets are produced in .177 caliber. Weight range of .177 caliber pellets run from a light 6.5 grains (the Beeman Laser) to a so-called heavy 11.5 grains (the Beeman Silver Arrow). The British airgun publications list a very light pellet, called the Dynamic PPP1, which weighs in at 5.0 grains. The English also list a real heavyweight, called the H&N Rabbit Magnum, that weighs 16.85 grains.

.20 Caliber

The popularity of the .20 caliber may have actually reached its peak, and only time will tell if the .20 caliber continues to gain new followers. Beeman continues to highly recommend the .20 caliber as the most effective for downrange retention of velocity and energy. Field target competitors occasionally take a liking to the .20 caliber, however it is not selected with the same frequency that even approaches the popularity of the .177 caliber.



.20 caliber pellet varieties L to R: Original old style 15 grain Sheridan Cylindrical, Beeman Silver Ace, Beeman Silver Jet, and a Crosman Premier for comparison.



L to R: .177 caliber 10.5 grain Premier, Gamo (.177) 8 grain round lead shot, typical 5.3 grain steel BB.

Upstart Sheridan Airgun Company helped to popularize this caliber back in 1947, when they marketed their first pneumatic pump rifle. The Sheridan Airgun Company was so enthralled with the .20 caliber that they selected it as their exclusive caliber.

During the early 1980's, Beeman started marketing many new .20 caliber pellets commensurate with new matching-caliber air rifles. If it were not for Beeman's big advertising campaigns and importation of .20 caliber airguns, the caliber might have almost vanished from the airgun scene altogether. I have been shooting a .20 caliber airgun regularly since 1986, the date of my first selecting a new Beeman R-10. Later, many .20 caliber airguns adorned my collection.

The 14.3 grain .20 caliber Premier pellet, while a heavy pellet considering its caliber, has proven to be the best of the Premiers (at least in my tests) when it comes to aerodynamics. I generally save the .20 caliber Premier for use in my more powerful rifles, because it seems to perform best when pushed to at least 680-700 fps.

Weight range of normal .20 caliber pellets vary from a light 9.20 grain Beeman Laser to a heavy 15.50 grain Beeman Silver Arrow. Out of the realm of a normal weight pellet is the Korean .20 caliber



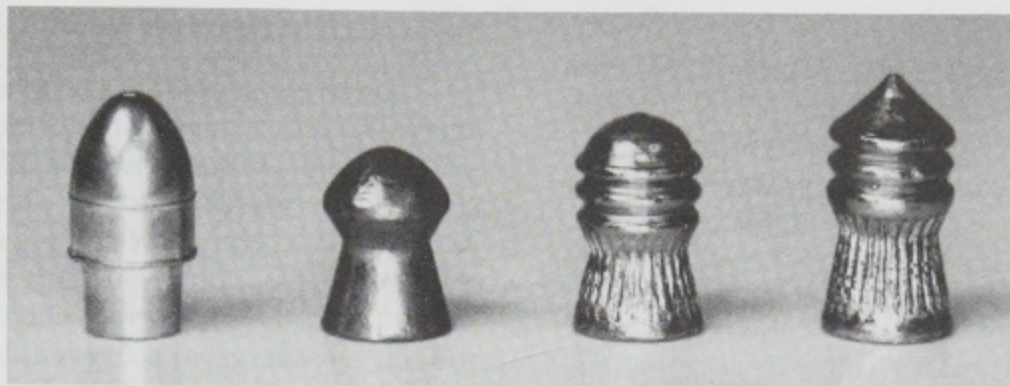
The holes in the bars of soap show the difference in displacement between calibers. Left, a hole from a .177 caliber Premier and right, a hole from a .22 caliber Premier.

24.2 grain Dae Sung pellet, which is designed for use in the very powerful Career PCP rifles.

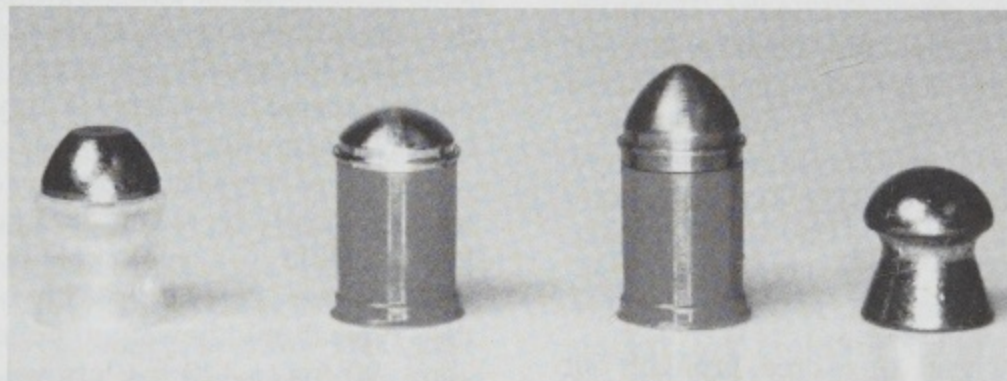
.22 Caliber

In the U.S., our domestic airgun manufacturers have always promoted the .22 caliber as the ideal caliber for small game and varmint hunting. Not so in Europe, as they highly regarded the .177 caliber for such duties, and only fairly recently have unequivocally endorsed the .22 caliber for hunting purposes. For decades there has been a behind-the-scenes debate going on about which is the best airgun caliber for hunting. (This debate is still alive, although now it includes additional advocates promoting the .20 and .25 calibers as well.)

Weight range of normal .22 caliber pellets vary from a light 11.9 grain RWS Hobby pellet to a heavy 21.1 grain Beeman Kodiak. Again, out of the realm of normal weight pellets are the Korean 28.5 grain Dae Sung and the British bullet shaped 30 grain Eley Magnum, as well as the 30 grain H&N Rabbit Magnum.



.22 caliber heavy pellets L to R: 16.6 grain Ox Nato Bullet, 21.1 grain Beeman Kodiak, 28.5 grain Dae Sung, and a 32 grain Ultra-Mag (from Air Rifle Specialists).



Three unconventional .22 caliber pellets next to a .22 caliber Crosman Premier. L to R: Prometheus 8.8 grain Truncated with a head made from a zinc alloy, 11.5 grain Prometheus Paragon Z2, which features a zinc alloy dome head, 17.6 grain Prometheus Paragon C1, which features a copper bullet shaped head, and for comparison a 14.3 grain Premier. Prometheus pellets have a harder than lead alloy, and they are recommended for use in non-choked airguns.



.25 caliber heavy pellets L to R: Beeman 30.9 grain Kodiak Match, 35 grain Dae Sung, and a bullet shaped 50 grain Mongoose Magnum.

.25 Caliber

During the early 1990's, Beeman Precision Airguns introduced several high power .25 caliber model airguns, and this helped immensely to popularize the .25 caliber. High power .25 caliber airguns are easily capable of delivering 25 to over 30 foot pounds of energy. Beeman touts the .25 caliber for carrying the most knockdown force to the target.

My own experience with my .25 caliber airguns would tend to coincide with Beeman's, with one caveat — it depends on the distance to the target in question. There is no doubt that the .25 caliber is capable of great knock down power, however, when shooting out to distances greater than about 60-70 yards, I generally prefer a more aerodynamic .22 caliber pellet to any current .25 caliber pellet on the market. While the .25 caliber Beeman Kodiak pellet has a respectable B.C. of around .037, (when tested in my guns) you must also remember it weighs 30 grains and, as a result, its trajectory tends to be somewhat loopy, even when shot from an air rifle like the powerful Beeman Kodiak.

9mm

Shin Sung Industrial of Korea brought out their Career 9mm PCP rifle with the intent of it becoming a more effective short-range hunting tool for use on larger critters. It is far easier to hunt with an airgun in Korea, than it is with a firearm, hence the high popularity of airguns in Korea. The 9mm Career Ultra, which is marketed in the U.S. by RWS, is reported to be able to push a 60 grain pellet to 1015 fps, which is equal to 137 foot pounds of energy. While a 9mm pellet puts out a healthy dose of energy, it also drops rapidly after 60 yards. A friend of mine shoots a 9mm Career air rifle and reports that when he zeroes his 58 grain Dae Sung pellet at 50 yards it will drop around 10"-11" at 75 yards.

Muzzle Energy and Velocity

It is always a good idea to test a new or used airgun's performance by shooting it over a chronograph. In fact, periodically I shoot all my airguns over a chronograph, simply for the peace of mind that comes when I have verified that each gun is shooting normally and has remained stable. For those of you who wish to convert velocity to energy in foot pounds, airgunners use the following formula. It is: $\text{Ft.-lbs.} = \frac{\text{velocity in fps}^2 \times \text{weight in grains}}{450,240}$. However, in Britain they generally use the more precise (in sciences-oriented circles) factor of 450,436. Remember, in Britain shooters must keep their airgun's energy output under 12 foot pounds, or it is considered a firearm, and the factor 450,436 actually represents a lower energy output, so the Brits have a tiny smidgen more leeway when using this divisor.

Published velocity figures by airgun manufacturers typically represent the lightest weight pellets available. If a catalog claims a particular air rifle achieves, say 930 fps, it would be a safe bet that typical middleweight pellets would clock about 90 fps to 140 fps less velocity, when shot over a chronograph. Another surprise — when energy figures are published in a typical airgun catalog they're usually based on a heavier pellet, in order to illustrate a higher figure. The uninformed potential airgun buyer may be unaware of this marketing ploy. Also, be aware that when you see a high powered air rifle with a rated muzzle velocity anywhere from about 1100 to 1250 fps the velocity is based on a very light weight pellet, and when you read the gun's instructions you will discover that extra-light weight pellets are not even recommended! Such lightweight pellets, when pushed to such extreme velocities,



Heavy weight pellet varieties L to R: .22 caliber 30 grain Eley Magnum, .22 caliber 28.5 grain Dae Sung, .25 caliber 35 grain Dae Sung, .25 caliber 30.9 grain Beeman Kodiak Match, and a 9mm 58 grain Dae Sung.



.177 caliber light-weight pellets L to R: 6.5 grain Beeman Laser, 6.9 grain RWS Hobby. These type of pellets generally work best in low to medium powered airguns and may shoot harshly in high velocity air rifles.

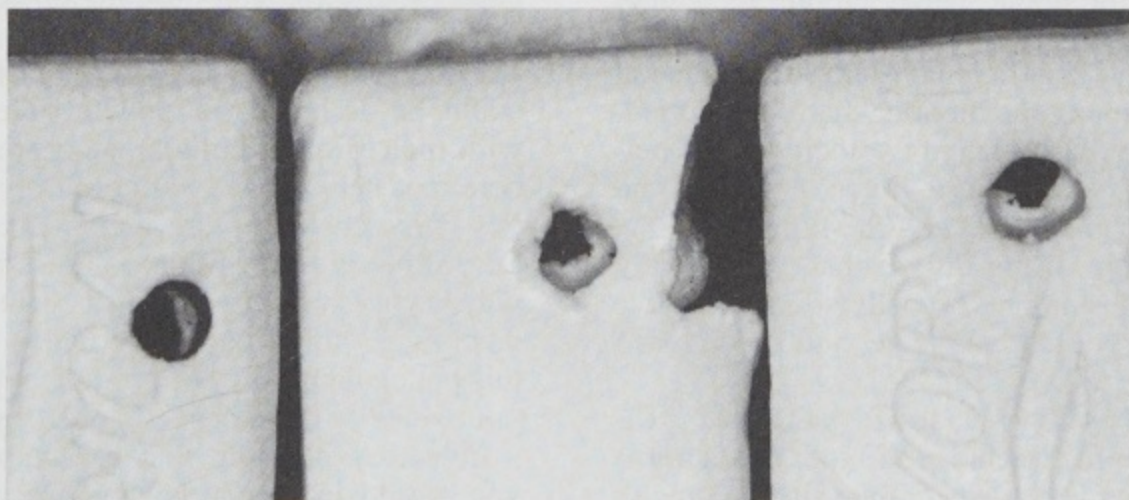
almost always promote poor accuracy, and when shot from a high-power spring gun, give a harsh and esthetically unpleasant recoil sensation that is hard on the gun's internal parts.

When you see airgun velocities that are advertised upwards of 1100 fps to 1250 fps, they are used as a sales come-on, and they are aimed primarily towards the firearm shooter. The advertising executives are betting that the potential airgun buyer will be tuned to think that extra-high pellet velocity is the ultimate feature and should logically be compared to standard velocity .22 rimfire ammunition. In the above context,

the advertised "super" air rifle will appear to be superior to the average .22 rimfire rifle. For this plan to work, the ad writers hope the air rifle buyer is not savvy about airgun velocities and eccentricities.

Airgun Ballistics

Most ardent shooters know the basics about ballistic coefficients, but for those uninformed, I will give a quick review. Ballistic coefficient (B.C.) is a ratio based on a standard model sporting bullet and its drag function. This drag function is called "G1" and is a reference table showing how fast this projectile (with a B.C. of 1.0) is shedding velocity. When one talks about the B.C. of a particular bullet, we are referring to its rate of velocity loss, as compared to the standard model sporting bullet. For instance, if a tested projectile loses velocity twice as fast as the standard "G1" bullet, it is said to have a B.C. of .50. If a test projectile retains its velocity better than the standard, it would be given a B.C. of greater than 1.0 (The only projectiles that I know of, in a sporting sense, that have this high of a B.C. are those of .510 caliber.) In essence, B.C. describes a projectile's ability to overcome the resistance of the atmosphere during flight. The higher the number the more streamlined the design. Ballistic coefficients are given as a three-



Soap penetration tests conducted at 20 yards show soap displacement from different airguns and different projectiles. L to R: .25 caliber 35 grain Dae Sung pellet fired from a Career 710T, .22 caliber 28.5 grain Dae Sung pellet fired from a Career 710T, (which cracked a chip out of the corner). Far right, a hole made by a .22 caliber Long Rifle rimfire hollow point bullet, (CCI Mini-Mag 36 grain HP). Soap displacement from all the above tests appears to be very similar. However, the airgun pellets actually out penetrated the .22 rimfire hollow point bullet, but showed practically no expansion.



Testing the .25 caliber against the .20 caliber. Left, a hole in soap that resulted from an impact at 10 yards with a .20 caliber Crow Magnum pellet that was fired from author's Theoben Eliminator. Far right, impact at 10 yards with a .20 caliber Crosman Premier (showing the smallest hole, but gave deep penetration). Center, impact at 10 yards from a .25 caliber Dae Sung pellet showed the biggest displacement and the most soap distortion, which suggests the .25 caliber may be the most effective against larger critters.

digit number, and this B.C. represents a relationship among a projectile's weight, diameter, and shape. Ballistic coefficients are also not cast in stone, as they normally vary during a string of shots and the B.C. figure quoted is a mean figure.

The ballistic coefficient of a pellet will also vary depending upon which airgun it is shot from. The reasons for these widely wandering airgun ballistic coefficients stem from several factors, and among the theories that I heard mentioned include: barrel length, velocity of the pellet, pellet fit to the bore, internal finish and smoothness of the barrel and the type of rifling, the depth of the rifling grooves that engrave into the pellet, the amount of pellet distortion, the amount of choke at the muzzle, and pellet lubrication, or lack thereof.

If the goal is to standardize ballistic coefficients, data must include altitude and atmospheric conditions at the test range site, so precise comparisons can be made. Next, the data can be converted to the accepted standard atmospheric conditions, which are as follows: 59°F, 29.53 in. Hg. Air pressure, 78% humidity, and sea level.

Airgun pellets, being very light in weight, are blessed (or cursed, depending upon your prospective) with notoriously low ballistic coefficients. You could almost say most airgun pellets have built-in parachutes. The ultra-low B.C.'s of

most airgun fodder is what restricts their range and makes airgun shooting safer.

It is my theory that the standard "G1" projectile is so far removed in a ballistic sense from a typical airgun pellet that the trajectory specifications from most firearms-based trajectory computer programs are not usually noted for pinpoint accuracy.

Perhaps multiple ballistic coefficient figures could be assigned for pellets (like Sierra does with their firearm bullets) suggesting the theory here that pellets have variable flight characteristics commensurate with their velocity decrease. So, in theory only at this point, if you had computed your velocity data at several distances downrange for a particular pellet and assigned this pellet a multiple B.C. figure, depending upon your velocity data, then entered all your data into a trajectory program that uses multiple B.C.'s, you would in theory have more accurate data. Someday, when I have more time and additional chronographs to setup, I plan to try this experiment.

Recently, specific airgun dedicated trajectory computer programs have surfaced and these are definitely worth looking into. Among these include: The A team's ATEAB (A Team Easy Airgun Ballistics) program, Lane Rabbit's AIR RIFLE Ballistics, while PASA (Bob Winer &



The above Beeman Pellet sizers allow the airgunner to tailor his pellet's dimension to his gun for the utmost in accuracy.

— Photo courtesy of Beeman Precision Airguns.

David Shames) markets a program called Airgun Trajectory Program.

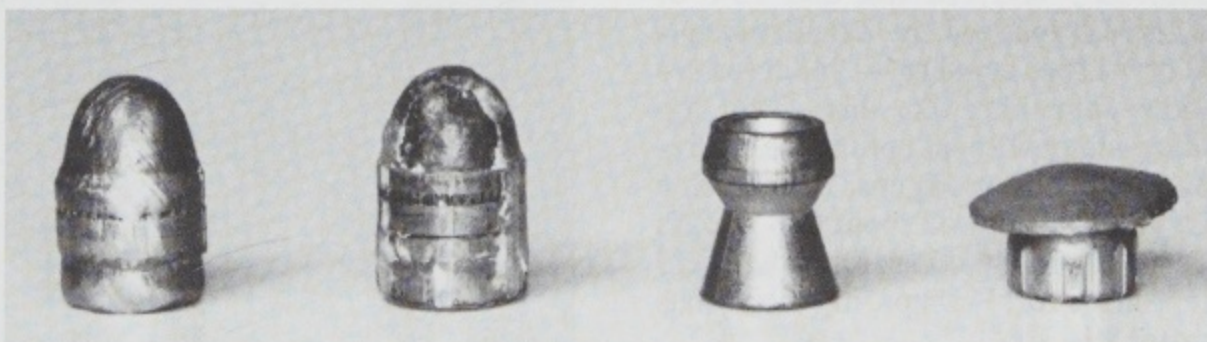
Ballistics and the Speed of Sound

Facts about the speed of sound: The speed of sound at the standard air temperature of 59°F is 1,116 fps. The much referred to speed of sound figure of 1,080 fps is actually only correct at a temperature of about 24°F. The speed of sound slows with an altitude increase, because this is due to a lower temperature, and not because of

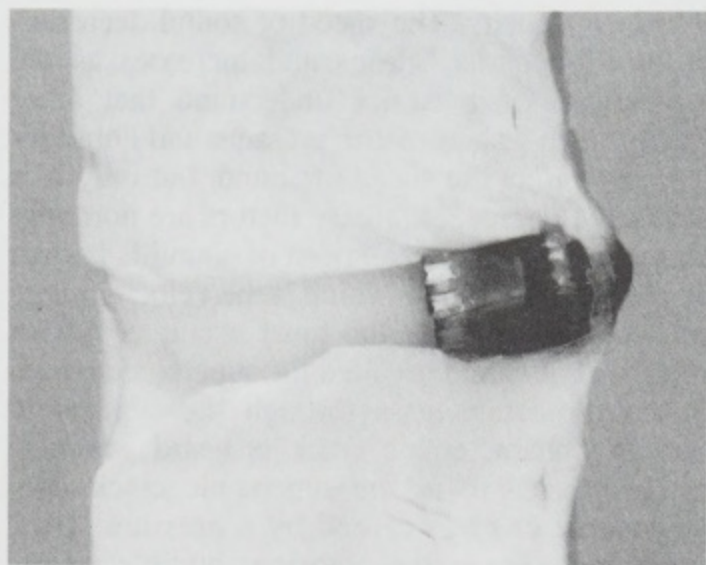
lower air density. The speed of sound decreases as the temperature drops and increases as the temperature increases. I understand that other factors such as barometric pressure and humidity can also effect the speed of sound, but only to a miniscule degree, and these factors are normally disregarded. Below the speed of sound is known as the subsonic range, which is the velocity range in which airguns are the most accurate. Above the speed of sound is called the supersonic range. When projectiles pass through the supersonic range, a characteristic crack is heard which is often referred to as the supersonic crack. The supersonic crack is caused by a pressure shock wave that creates the notorious audible disturbance.

A while back, I watched an interesting documentary about airspeed. I learned that test pilots from the 1930s held the opinion that the speed of sound would never be reached, because of the terrific buffeting effects that precede that range of speed. Test pilots that eventually broke the speed of sound commented that when they approached within 90% of the speed of sound air buffeting and turbulence became intense. This buffeting was at its worst when they reached approximately 95% of the speed of sound; however, after they crested over the speed of sound it suddenly became a much smoother flight.

Permit me the luxury to theorize for a moment about pellet velocity and inaccuracy. Remember air turbulence (according to the pilots) becomes very intense at around 90% of the speed of sound, and I think this turbulence and buffeting



The above photo (left) shows two .22 short rimfire bullets that were shot through soap bars to test for penetration. These rimfire projectiles showed no expansion and actually penetrated less than some .22 caliber airgun pellets that were fired from the author's high power air rifles. Center-right, an unfired .20 caliber Beeman Crow Magnum pellet. Far right, a .20 caliber Crow Magnum pellet that was recovered from soap, which was shot from author's Theoben Eliminator and shows considerable expansion. The above demonstrates to the author the reason why some air rifles with certain pellets are indeed more effective than a .22 short, when both are used against short-range pests.



A .25 caliber Kodiak Match pellet stuck in a bar of soap that was fired from a Beeman Kodiak air rifle. At ten yards the author's Kodiak air rifle generally pushed the Kodiak pellet through five bars of soap for an average, but this particular pellet became lodged in the fifth bar, while cracking the bar of soap in half. Notice the grooves etched into the pellet from the barrel's rifling.

effect is strong enough to disrupt and cause inaccuracy from a speeding airgun pellet in flight. So if I wish to avoid shooting my pellets through this most turbulent range, I should keep my velocity a bit lower than 90% of the speed of sound. Surmising that a 5% leeway should be enough, I have come to the conclusion that I should shoot pellets no faster than, perhaps, 85% of the speed of sound. The speed of sound at the standard air temperature of 59°F is 1,116 fps, and 90% of 1,116 fps is 1,004.4 fps, and my calculator tells me that 85% of 1,116 is equal to — 948.6 fps. So my theory goes something like this — for top airgun accuracy, along with an optimal pellet trajectory within the realm of airguns, I can push a pellet up to a velocity limit of about 948 fps. As it turns out, 948 fps is the upper limit that field target shooters strive for! Perhaps, my theory has some merit after all.

Ten-meter target shooters consider a velocity range of 500 fps to around 650 fps as the best, when aiming for superior crème de la crème accuracy. Field target shooters require more energy from their lead, than ten-meter shooters, to reliably knock over their targets and generally prefer velocities (in .177 caliber) from about 720 fps to about 900-930 fps. It appears that not many

top field target shooters strive for velocities much over 900-930 fps.

For the sake of riflemen who shoot both firearms and airguns, I constructed a ballistics table to show how typical airguns compare ballistically to six common firearm cartridges. Many shooters don't fully realize the extreme difference between airgun pellets and firearm based projectiles, in regard to wind deflection and drop.

Data came from an older ballistics program called FireLine. FireLine is one program that works with airguns too, because it will accept extremely low ballistic coefficient data and also lightweight pellet projectile data.

All examples are based on a fifty yard zero and a five mph, 90-degree crosswind. Scope height of 1.9 inches. Altitude 500 feet, Temp = 59°F, Standard barometric pressure. Drop is figured at 100 yards. Firearm ballistics obtained from the manufacturer's published data and extrapolated by the FireLine program.

Type	muz. velocity/ fps/100 yard	muz. energy ft./lb./100 yard	Drop /inch 100 yard	wind deflection 100 yard
AIRGUNS				
HW-97-.177 7.9 gr Premier	914/553	14.7/5.4	-15.87"	8.80"
Theoben Eliminator .20 14.3 gr Premier	855/588	23.2/11.0	-15.64"	6.67"
Whiscombe JW80 .22 14.3 gr Premier	960/596	29.3/11.3	-13.81"	7.99"
Theoben Dual Mag .22 21.1 gr Kodiak	798/566	29.8/15.0	-17.67"	6.44"
Beeman Kodiak .25 30.9 gr Kodiak M.	642/443	28.3/13.4	-29.03"	8.74"
RWS-Career 710T .22 28.5 gr Dae Sung	830/615	43.6/24	-15.25"	5.34"
FIREARM CARTRIDGES				
.22 Short CCI Target 29 grain solid	830/ 688	44.4/ 30.5	-13.43"	3.22"
.22 LR CCI Mini Mag 36 grain HP	1280/ 1028	131/ 84.6	-4.92"	2.69"
.22 WMR Rem. Premier 33 grain V-Max	2000/ 167	293/ 167	-0.97"	2.04"
.22 Hornet Hornady 35 gr. V-Max	3100/ 2270	747/ 400	+0.67"	1.46"
.223 Rem. Remington 50 gr. V-Max	3300/ 2884	1208/ 923	+0.99"	0.56"
.30-06 Win Fail Safe 180 grain	2700/ 2483	2913/ 2464	+0.61"	0.42"

Ballistic Coefficient TEST RESULTS/
Oehler 35P Chronograph /
and a ProChrono by Competition Electronics Inc.
 Tests indicated that these chronographs gave virtually identical velocities.

Chronographs spaced exactly 10 yards apart.
 All shots recorded indoors using indoor lighting setup for each chronograph.

Temperature = 60°F, altitude 300 feet – (not corrected to sea-level), Variable barometric pressure from 29.5 to 29.7 in. Hg. Air pressure. Data based on 25 shots, and was entered into a ballistic program called FireLine, which extrapolated the data.

I thought it was interesting that a particular pellet's ballistic coefficient varied, depending upon which airgun it was shot from. Also note that on every occasion when I used a factory non-tuned spring gun for ballistic coefficient testing, then had the airgun tuned, and subsequently, when I re-tested, — all pellets showed improved ballistic coefficients! I can only surmise that the

improved harmonics from a tuned gun affect the flight of the pellet for the better, and this shows up with the pellet gaining a slightly better B.C.

Also note that when I swabbed my Theoben Eliminator's barrel with J-B Bore cleaning compound, it increased the B.C. by .003 for an average, and accuracy also improved. However, after the J-B was applied the average velocity dipped a tad. My guess is that the J-B Bore Cleaner improved the internal finish of the barrel and this accounted for the difference.

Test Airgun	Tuned Air Arms TX200SR .177 Caliber
Pellet tested	Crosman 7.9 gr. Premier FT
Avg. Muz. Velocity:	840 fps
Avg. B.C.	.028
Hi	.033
Low	.026
ES	.007

Test Airgun	Tuned Air Arms TX200SR .177 Caliber
Pellet tested	Crosman 10.5 gr. Premier FT
Avg. Muz. Velocity:	701 fps
Avg. B.C.	.031
Hi	.038
Low	.028
ES	.010

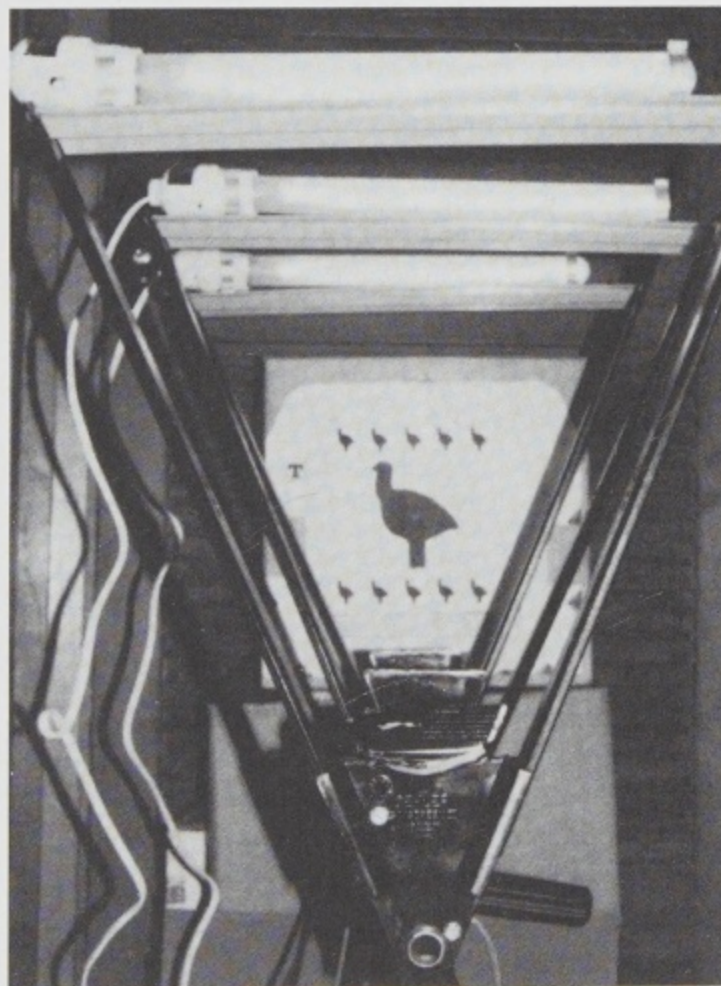
Test Airgun	Tuned Beeman HW97 .20 Caliber
Pellet tested	Crosman 14.3 gr. Premier FT
Avg. Muz. Velocity:	677 fps
Avg. B.C.	.039
Hi	.042
Low	.036
ES	.006

Test Airgun	Tuned Beeman HW97 .20 Caliber
Pellet tested	Beeman 11.2 gr. FTS
Avg. Muz. Velocity:	733 fps
Avg. B.C.	.032
Hi	.036
Low	.028
ES	.008

Test Airgun	Tuned Beeman R7 .177 Caliber
Pellet tested	Crosman 7.9 gr. Premier FT
Avg. Velocity:	647 fps
Avg. B.C.	.026
Hi	.030
Low	.023
ES	.007

Test Airgun	Factory Beeman HW97 MkIII .177 Caliber
Pellet tested	Crosman 7.9 gr. Premier FT
Avg. Velocity:	843 fps
Avg. B.C.	.026
Hi	.033
Low	.024
ES	.009

Test Airgun	Mac-1 Power-tuned Beeman HW97 MkIII .177 Caliber
Pellet tested	Crosman 7.9 gr. Premier FT
Avg. Velocity:	914 fps
Avg. B.C.	.028
Hi	.032
Low	.026
ES	.006



Author used chronographs with indoor lights to determine velocity and ballistic coefficients. Above, on Oehler 35P chronograph setup with the optional indoor lights.

Test Airgun Lazaglide tuned Beeman R1 .22 Caliber
 Pellet tested Crossman 14.3 gr. Premier FT
 Avg. Velocity: 832 fps
Avg. B.C. .032
 Hi .035
 Low .028
 ES .007

Test Airgun Lazaglide tuned Beeman R1 .22 Caliber
 Pellet tested Beeman 21.1 gr. Kodiak
 Avg. Velocity: 673 fps
Avg. B.C. .037
 Hi .039
 Low .033
 ES .006

Test Airgun Lazaglide tuned Beeman R1 .22 Caliber
 Pellet tested Dae Sung 28.5 gr. Dome
 Avg. Velocity: 530 fps
Avg. B.C. .044
 Hi .048
 Low .042
 ES .006

Test Airgun Beeman Super Tuned Kodiak .25 Caliber
 Pellet tested RWS Diana 21 gr. Magnum
 Avg. Velocity: 788 fps
Avg. B.C. .024
 Hi .029
 Low .019
 ES .010

Test Airgun Beeman Super Tuned Kodiak .25 Caliber
 Pellet tested Dae Sung 35 gr. Domed
 Avg. Velocity: 591 fps
Avg. B.C. .033
 Hi .035
 Low .030
 ES .005

Test Airgun Beeman Super Tuned Kodiak .25 Caliber
 Pellet tested Beeman 30.9 gr. Kodiak Match
 Avg. Velocity: 642 fps
Avg. B.C. .037
 Hi .041
 Low .034
 ES .007

Test Airgun Tuned Air Arms Pro Elite .22 Caliber
 Pellet tested Crossman 14.3 gr. Premier FT
 Avg. Velocity: 817 fps
Avg. B.C. .031
 Hi .035
 Low .026
 ES .009

Test Airgun Tuned Air Arms Pro Elite .22 Caliber
 Pellet tested Beeman 15 gr. FTS
 Avg. Velocity: 814 fps
Avg. B.C. .022
 Hi .024
 Low .019
 ES .005

Test Airgun Whiscombe JW80 .22 Caliber
 Pellet tested Crosman 14.3gr. Premier FT /lubed 50% STP-Hoppes
 Avg. Velocity: 961 fps
Avg. B.C. .030
 Hi .032
 Low .029
 ES .003

Test Airgun Whiscombe JW65 .20 Caliber
 Pellet tested Crosman 14.3gr. Premier FT /lubed 50% STP-Hoppes
 Avg. Velocity: 758 fps
Avg. B.C. .033
 Hi .035
 Low .031
 ES .004

Test Airgun Sheridan Silver Streak .20 Caliber / eight pumps
 Pellet tested Crosman 14.3 gr. Premier FT /lubed 50% STP-Hoppes
 Avg. Velocity: 599 fps
Avg. B.C. .025
 Hi .027
 Low .022
 ES .005

Test Airgun Theoben Eliminator (Crow Magnum) .20 Caliber
 Pellet tested Crosman 14.3 gr. Premier FT /lubed 50% STP-Hoppes
 Avg. Velocity: 867 fps
Avg. B.C. .034
 Hi .037
 Low .031
 ES .006

Test Airgun Theoben Eliminator (Crow Magnum) .20 Caliber/barrel lapped with J-B bore cleaning compound
 Pellet tested Crosman 14.3 gr. Premier FT /lubed 50% STP-Hoppes
 Avg. Velocity: 855 fps
Avg. B.C. .037
 Hi .040
 Low .035
 ES .005

Test Airgun Theoben/Beeman Dual Magnum .22 Caliber
 Pellet tested Beeman 21.1 gr. Kodiak /lubed 50% STP-Hoppes
 Avg. Velocity: 798 fps
Avg. B.C. .040
 Hi .042
 Low .038
 ES .004

Test Airgun RWS Tanker Carbine .22 Caliber
 Pellet tested Dae Sung 28.5 gr. Domed/ green power setting
 Avg. Velocity: 825 fps
Avg. B.C. .046
 Hi .049
 Low .043
 ES .006

Ballistic Sample courtesy of the "A" TEAM

THE "A" TEAMS Easy Airgun Ballistics Program
 Career 707 Free Floated ~ Premier 10.5 ~ 6/7/99

MUZZLE VELOCITY FT/S 880

DEAD ON ZERO RANGE IN YARDS

35 < This is your sight in Zero

GRAVITATIONAL ACCELERATION

32.16 < It is best to leave this alone

VELOCITY RETENTION FACTOR

.866 < Found in VRF Tables and tutorial

VELOCITY RETENTION FACTOR DIST

30 < The Distance The VRF was calculated at

SCOPE HEIGHT IN INCHES

1.6206 < Scope height as set by the Program

WEIGHT OF PELLET IN GRAINS 10.5

90 DEGREE WIND VELOCITY (MPH) 1

SCOPE MINUTE OF ANGLE @ 100 YDS

.1449 < Calculated Value from SMOA Tutorial

YARDS	VEL	FLBS	DRIFT	DROP	HOLD OR DIAL	YARDS	.1 "SC	TIME
10	838	16.4	0.01	-0.54	HIGH 37 UP	10	6.90	0.0349
11	834	16.3	0.02	-0.46	HIGH 29 UP	11	6.27	0.0385
12	830	16.1	0.02	-0.38	HIGH 22 UP	12	5.75	0.0421
13	826	15.9	0.02	-0.30	HIGH 16 UP	13	5.30	0.0457
14	822	15.8	0.03	-0.23	HIGH 11 UP	14	4.93	0.0494
15	818	15.6	0.03	-0.17	HIGH 8 UP	15	4.60	0.0530
16	815	15.5	0.04	-0.11	HIGH 5 UP	16	4.31	0.0567
17	811	15.3	0.04	-0.05	HIGH 2 UP	17	4.06	0.0604
18	807	15.2	0.05	0.00	ON 0 ZERO	18	3.83	0.0641
19	803	15.1	0.05	0.05	LOW 2 DOWN	19	3.63	0.0678
20	799	14.9	0.06	0.09	LOW 3 DOWN	20	3.45	0.0716
21	795	14.8	0.07	0.12	LOW 4 DOWN	21	3.28	0.0753
22	791	14.6	0.07	0.15	LOW 5 DOWN	22	3.13	0.0791
23	788	14.5	0.08	0.17	LOW 5 DOWN	23	3.00	0.0829
24	784	14.3	0.09	0.19	LOW 5 DOWN	24	2.87	0.0867
25	780	14.2	0.09	0.21	LOW 6 DOWN	25	2.76	0.0905
26	776	14.1	0.10	0.21	LOW 6 DOWN	26	2.65	0.0944
27	773	13.9	0.11	0.22	LOW 6 DOWN	27	2.55	0.0983
28	769	13.8	0.12	0.21	LOW 5 DOWN	28	2.46	0.1022
29	765	13.7	0.13	0.20	LOW 5 DOWN	29	2.38	0.1061
30	762	13.5	0.14	0.19	LOW 4 DOWN	30	2.30	0.1100
31	758	13.4	0.15	0.16	LOW 4 DOWN	31	2.22	0.1139
32	754	13.3	0.16	0.14	LOW 3 DOWN	32	2.15	0.1179
33	751	13.2	0.17	0.10	LOW 2 DOWN	33	2.09	0.1219
34	747	13	0.18	0.06	LOW 1 DOWN	34	2.03	0.1259
35	744	12.9	0.19	0.01	ON 0 ZERO	35	1.97	0.1299
36	740	12.8	0.20	-0.04	ON 1 UP	36	1.91	0.1340
37	736	12.7	0.21	-0.10	HIGH 2 UP	37	1.86	0.1380
38	733	12.5	0.22	-0.17	HIGH 3 UP	38	1.81	0.1421
39	729	12.4	0.23	-0.24	HIGH 4 UP	39	1.77	0.1462
40	726	12.3	0.25	-0.32	HIGH 6 UP	40	1.72	0.1503
41	722	12.2	0.26	-0.41	HIGH 7 UP	41	1.68	0.1545
42	719	12.1	0.27	-0.50	HIGH 8 UP	42	1.64	0.1586
43	716	12	0.29	-0.60	HIGH 10 UP	43	1.60	0.1628
44	712	11.8	0.30	-0.71	HIGH 11 UP	44	1.56	0.1670
45	709	11.7	0.31	-0.83	HIGH 13 UP	45	1.53	0.1712
46	705	11.6	0.33	-0.95	HIGH 14 UP	46	1.50	0.1755
47	702	11.5	0.34	-1.09	HIGH 16 UP	47	1.46	0.1797
48	699	11.4	0.36	-1.23	HIGH 18 UP	48	1.43	0.1840
49	695	11.3	0.37	-1.37	HIGH 19 UP	49	1.40	0.1883
50	692	11.2	0.39	-1.53	HIGH 21 UP	50	1.38	0.1926
51	689	11.1	0.41	-1.69	HIGH 23 UP	51	1.35	0.1970
52	685	11	0.42	-1.86	HIGH 25 UP	52	1.32	0.2013
53	682	10.9	0.44	-2.04	HIGH 27 U.	53	1.30	0.2057
54	679	10.8	0.46	-2.23	HIGH 28 UP	54	1.27	0.2101
55	675	10.7	0.48	-2.42	HIGH 30 UP	55	1.25	0.2146

YARDS

This is the yardage from the muzzle that the results are referenced to

VEL

This is the velocity of the pellet at the given yardage from the muzzle

FLBS

This is the foot pounds that the pellet carries at the given yardage from the muzzle

DRIFT

This is the amount of wind drift (left or right) due to the MPH of the wind you put into the program. In the chart above the pellet will move .39 inches sideways due to a 1 MPH wind. You can enter a 5,10 or any mile an hour wind that you like.

DROP

This is how high or low the pellet is in relation to the line of sight through the scope at the given yardage from the muzzle

HOLD

This tells you to hold High or Low. You hold the amount given in the Drop Column

OR DIAL

This is how much to click the scope and the direction to click it so that the pellet will hit where the cross hairs are centered at the given yardage.

YARDS

Same as YARDS above

.1 "SC

This is how many clicks it takes to move the point of impact 1/10th of an inch at the given yardage

TIME

This is the time of flight of the pellet

CHAPTER FOUR

Airgun Varmint Hunting & Pest Control



My brand new big red Webster's Dictionary defines a **Varmint**: A bird or animal regarded as undesirable or troublesome. (*Informal variation of vermin*) So I looked up **Verm**: An insect or small animal that is destructive, annoying, or harmful to health, as the cockroach or the rat. — 2. An animal that preys on game, as the fox or the weasel.

Assorted Airgun Varmints

The common rat reigns supreme as man's most notorious and destructive varmint. Rats may weigh from around 6 ounces to upwards of 18 ounces, and measure from 12 inches to over 18 inches in length, which includes the tail. The rats' range includes the entire United States from coast to coast. Female rats may breed as early as 2½ to 3 months old and bear from 5 to 12 litters per year, while each litter brings forth anywhere from 2 to 22 more rats into the world. Rats are a major carrier of many diseases such as, typhus, spotted fever, tularemia, infectious jaundice, tapeworm infections, rat-bite fever, and bubonic plague. Rats are very destructive around docks and warehouses and have even been known to start fires.

Rats are commonly found around mankind and many times nest around or in buildings, and



The common rat, — one of the most destructive varmints on earth. Airguns provide an effective, practical, and safe means to help control the rat population.



Above, a common Columbian ground squirrel checks for predators before leaving the confines of an escape route.

common sense often dictates that firearms are overly powerful and out of place against these small pests. However, airguns are one of the few safe rat terminators that are not prone to over-penetrate, when used against these small vermin. Rat shooting is a short-range proposition and even inexpensive airguns with open sights are effective slayers. One tool that aids the rat shooter is the spotlight. My rat shooting has been a late evening or night sport, and I frequently use a Nightforce spotlight with a red filter, which has proven to be very effective.

The Western varmint hunter has countless species that beckon for his attention. The many



The common and destructive Black-tailed Prairie Dog provides a medium sized target for the practiced airgun hunter.



Above, a Yellow-bellied Marmot (commonly called a rockchuck) represents the upper echelon size wise for the airgun hunter.

species of ground squirrels that are so prolific, troublesome, and destructive to the ranchers are also a popular target for the avid airgunner. During my many hunts, I have found the most common to be the Richardson's and Columbian species. These species of ground squirrels generally weigh around 1 to 2 pounds and measure 10 to 16 inches in length. Ground squirrels are not especially timid, unless they have been hunted extensively with firearms. Often I hunt these rodents with airguns at distances of 20 to 50 yards. Shooter concealment and camouflage clothing are usually not needed against these less intelligent rodents.

The next rung up the rodent ladder is the common Black-tailed prairie dog. Actually the prairie dog is not any type of dog at all, but in reality is only a large burrowing ground squirrel. These plump, tawny-colored rodents can vary in length from 13 to 17 inches. They may weigh anywhere from about 2 pounds to a rather chubby 5 pounds.

Both the prairie dog and the many species of ground squirrels are very destructive to pastures, stemming from their burrowing tendencies and big appetites. One reference book estimates that between 32 and 50 of these rodents will eat as much forage as a typical cow. These rodents commonly carry fleas, and sometimes these fleas are carriers of the bubonic plague.

In my experience, prairie dogs are more easily spooked and are harder to approach than ground squirrels. If prairie dogs have not been shot at much from afar with centerfire rifles, the airgunner may have good luck shooting them at distances from around 40 to 80 yards. Air rifles that put out at least 20 foot pounds of energy

combined with head shots are the rule for the best results.

One of my specialties is hunting the western rockchuck, or Yellow-bellied Marmot (*Marmota flaviventris*). The rockchuck represents the upper echelon size-wise for the airgun hunter. These yellowish-brown and sometimes orange-reddish colored rodents are listed in my reference books as being from 19 to 32 inches in length and may weigh up to 18 pounds. A large rockchuck colony can threaten and damage many crops. When you consider that a rockchuck can eat more than a third of its weight in alfalfa per day, it's easy to understand why farmers have such a bad attitude toward them. A reasonable amount of hunting pressure has been known to control chuck infestations without the use of poisons, and many suburban ranchers are grateful to the airgun hunter. It is comforting to know that varmint thinning, and pest control via the airgun, rather than poisoning, is environmentally friendly.

Rockchucks can be quite wary and difficult to approach, especially if subjected to centerfire rifle hunting. The best bet for the airgunner is to



The common raccoon should be approached with caution because they are frequent carriers of rabies. Raccoons can become quite large, and as such they are a short-range proposition for the airgun hunter.

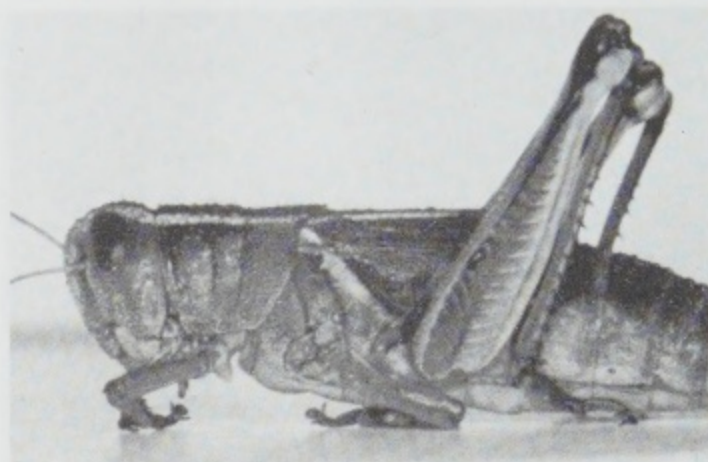
look for uninitiated rockchucks that are rarely hunted. Good stalking techniques and camouflage clothing are a big help. Good eyesight and scanning for danger is the rockchuck's forte. If a rockchuck spots you during your stalk the best strategy is to instantly "freeze", because any type of motion will quickly cause a chuck to scamper to its den. Try to keep the wind in your face, if possible. If your stalking route lacks cover and you need to get closer, you may need to construct some sort of cover or hunting blind.

If I were to approximate the minimum impact energy needed for head shots from a pellet, I would say 9 or 10 foot pounds for larger critters like, raccoons, opossums, and rockchucks; this is assuming the pellet is stout enough and shaped for adequate penetration. In my experience, the best pellets for maximum penetration are domed shape or pointed. The hollow points are great for shorter range use on smaller critters such as rats, ground squirrels, and small birds, but usually lack adequate penetration on the larger varmints.

An accurate airgun is paramount for successful hunting, and most ardent hunters conduct a series of accuracy tests with several brands and types of pellets. Generally, the larger the varmint, the larger the lethal area you have to aim for. For instance, a rockchuck usually provides me with a head shot hit-zone of at least 2" or 3" inches,



Airguns and pellets don't inflict nearly the physical damage that high velocity firearm bullets do, and an airgun should be considered when the intended varmint is destined for the taxidermist. Above, a rockchuck killed with a head shot .22 caliber pellet that was fired from a Theoben Dual Magnum at a laser ranged 93 yards in distance.



The common grasshopper provides the airgunner a challenging very short-range target.

while the smaller ground squirrel's head and neck shot hit-zone is oval shaped and about 1¼" to 1¾" inches. The airgun hunter needs to know what size his groups are at various ranges, so he can match his gun's accuracy to the range and to the varmint's lethal hit zone.

Other critters that airgunners are known for keeping under control include mice, crows, pigeons, magpies, starlings, opossums, raccoons, jackrabbits and sometimes even grasshoppers. Along with a set of compact binoculars, a very useful tool for the airgun hunter is the compact laser rangefinder.

Motivation for Hunting with Airguns

Compared to a hot centerfire cartridge such as the .220 Swift an air rifle's energy and velocity output seems quiet meager. *Airgun hunting is a game of finesse, rather than brute velocity and range. Don't expect an air rifle and pellet to eviscerate a varmint like a high velocity bullet from a .220 Swift or the like.* The airgunner must refine his stalking and still hunting skills to be able to shoot within his lethal range. Precise marksmanship and knowledge of a quarry's habits are essential. You may discover that successful airgun hunting is more challenging and rewarding than long-range firearm hunting.

Why do I hunt with an airgun? For me airgun hunting is sometimes a necessity, and other times I simply thrive on the challenge involved in dealing with the limits of an airgun. As a kid, my youthful indulgence in airgun shooting was both fun and sometimes a necessity for keeping the neighborhood rats and miscellaneous vermin under control. Since I liked to shoot a lot (still

do), I also discovered I could shoot an airgun virtually every day of the year.

During the last dozen years, or so, my airgun hunting has been a mixed bag; permit me to digress so I may explain in more detail. About a quarter of the time I choose to hunt with an airgun, simply because the challenge motivates me. Other times (on certain ranches) it became a choice of hunting with an airgun, or not hunting at all. During the past several years, many known ranchers changed their shooting policy and no longer allow firearm shooting (even rimfires) for fear of stray shots and ricochets. My airgun hunting, under these rules, became a necessity, as these particular ranchers cheerfully allowed airgun hunting to help control their various varmints.

One of my longtime pursuits has been long-range varmint hunting (still is), as I shoot a multitude of custom and semi-custom centerfire varmint rifles. Over the course of about 30 years my prime targets were rockchucks, prairie dogs, and various ground squirrels. Through the years, my technique improved and my equipment evolved enough that the aforementioned varmints were in serious trouble even at ranges out to around 500-700 yards. I use a variety of sophisticated laser and optical rangefinders to discover the true distance to my targeted rodents. Careful use of these rangefinders by my hunting partners and me, also prevents the proverbial "fish-story". Other equipment in my repertoire includes portable shooting benches, wind flags and wind speed indicators or anemometers. I use computer generated trajectory charts for each rifle and load, so once I know the actual distance to a potential target I have a fair chance of making a first shot kill.

The real challenge for me soon became the 1,000 yard ranged varmint. One problem that soon surfaced with my ultra-long range varmint shooting exploits was in trying to locate enough places to safely shoot. Instead of finding more open land to safely hunt and shoot, I was losing places to shoot every year. After driving 500 miles or so to reach a potential hunting destination, it became discouraging to discover I could no longer shoot a firearm on land that previously I had great success on. Land ownership was changing hands faster than ever before, which made it difficult for me to obtain permission to hunt. I was spending much more time simply driving around looking for places to hunt and shoot long distance, rather than shooting. Since I



Grazing land, as pictured above, where both varmints and livestock roam freely is frequently not conducive to firearm hunting. However, under these conditions the author has had excellent luck in obtaining permission to hunt with an airgun.

like to shoot a lot albeit with enough of a challenge to stimulate me — I started expanding my airgun hunting and my airgun arsenal. I discovered I could more easily obtain permission to hunt with an airgun and therefore spend much more time actually hunting and shooting. Airgun hunting has also put the challenge back into the hunt, as I need to routinely stalk my prey, instead of simply shooting prey from afar with a center-fire rifle.

Airguns of my Youth

Throughout my childhood I was able to shoot airguns most any time I wished. As a youth, I lived (with my parents and siblings of course) near the edge of town on a one-acre parcel of land that had a tall hedge around the circumference. All of such made it fairly easy to shoot airguns, while not attracting attention. However, such was not the case when it came to shooting an actual firearm. Firearm shooting as a youth, involved rounding up a willing chauffeur to drive me a minimum of 20 miles to a suitable location. Therefore, the bulk of my youthful indulgence in the shooting sports meant airgun shooting!

Small wooded areas and swamps surrounded my little neighborhood of the past. These wooded areas just happened to be filled with assorted troublesome critters and pests. Reminiscing back to my youth . . . I truly believe I was a lucky boy. You see, several older neighbor kids of my acquaintance were also into airgun shooting, which provided me an opportunity to shoot a wide variety of airguns at a young age. As a youth, I spent most of my free time plinking and



Above, a vintage Crosman model 160 bolt action .22 caliber CO₂ air rifle. This classic airgun is graced with a Simmons Pro Air 4-12X-40mm scope and B-Square mounts.

informally testing popular airguns of the era. Occasionally, a few of the neighbor kids would invite their airgun-devotee dads to shoot with us. This arrangement meant a pre-ordained shooting stint with a few adult type spring-piston air rifles, which at the time were somewhat rare in the United States. (Unfortunately my memory fails me as to the exact models.) My early experiences in the shooting sports were always considered clean wholesome family fun, and not something evil that many uninformed present-day liberal government officials allege.

A few of the coveted and briefly borrowed (however presently discontinued) CO₂ air rifles that I recall shooting were the Crosman models 160 and 99. The somewhat gas hungry .22 caliber Crosman 160 is powered by two 12-gram CO₂ cartridges. The model 160 seemed, at the time, to possess formidable power and range, and I wished for the day when I would own one. (The model 160 could propel lightweight .22 caliber pellets to around 600-630 fps.) The model 99, also a .22 caliber, was an accurate lever action repeater that was powered by a single CO₂ cartridge. I used both of these airguns to help quell the mounting population explosion of neighborhood rats, mice and starlings. Several years later, I actually acquired my own model 99 and still use it today as a tin can plinker and rat eliminator. My nearly 35 year old Crosman 99, with fairly new seals, propels .22 caliber Copperhead wad-cutter pellets to an average velocity of 526 fps,

which cleanly kills rats out to 25 yards or so.

I also shot many pneumatic powered airguns in my youth. Among these were the Crosman models 140, 1400 and 760. The model 140, a multi-pump, was used more so when our little shooting group was low on CO₂ cartridges. Velocity with about 7 or 8 pumps was supposed to be about the same as the Crosman 160. None of the shooters in our little pack did as well with the pump-up pneumatic guns; it most likely had something to do with the fairly noisy pumping involved, which often spooked the pests away.

I started saving my hard earned cash for my very own .22 caliber Crosman model 160. Of course, my dad was concerned I would be going through way too many CO₂ cartridges and would be in debt to him until I retired. It's true, I would have shot way too much — to own a CO₂ powered gun for my own good. For the most part, I realized with my meager budget that I needed a self-powered airgun in either pneumatic or spring-piston form. When I hit the age of about ten, I graduated from my old Daisy BB gun and Marksman pistol and moved on up to a spring-piston rig. My dad had found a deal on a BSA Meteor rifle in .177 caliber and surprised me.

Guns, Crows, and other Varmints

My, how time flies when you're having fun. I have been shooting pesky crows with airguns for over 30 years now. It all started back in the late

1960's. When crows invaded our family garden I simply brought out my spring-piston BSA Meteor pellet rifle (muzzle velocity was around 625-650 fps in .177 caliber). I was after brazen city-oriented crows which were used to having their own way around city people and were not particularly spooky. Stalking to within about 20-25 yards of these crows was not considered to be really Machiavellian. (Shooting the spooky country crows was an entirely different story). I knew that I had connected with these crows, because I could clearly see some feathers fly upon pellet impact. However, perhaps 30% to 35% of these crows managed to escape from my earnestly placed shots to their upper chest. I decided to try and stalk closer to my prey. I also used a bit of trickery on these old city crows; I placed a plastic owl decoy on the other side of the cornfield that was about 15-20 yards from my hiding spot. I actually hid very carefully within the cornfield while wearing camouflage clothing and surprised the crows with shots from around 10 to 15 yards, or so. My strategy worked! The crows died nearly instantly from the close-quartered shots. Most of the time the un-wily crows paid more attention to that old owl decoy, which made it easier for me to sneak up upon them. But alas, I was fully aware that my .177 pellet rifle seemed to be borderline, as far as possessing practical hunting lethality, and I longed for a more powerful air rifle.

During this period of my childhood, and much to my dismay, the Crosman model 160 .22 caliber was a rifle of the past and no longer in production. Although saddened by the thought of never owning a model 160 it was perhaps best at that point in my life that I was not tempted by the gas hungry and albeit expensive to shoot Crosman 160 any longer. My airgun dreams moved on to other brands and models. I remember dreaming about a new Sheridan, Crosman, or possibly a Benjamin multi-pump pellet rifle. I had all the latest airgun catalogs at the time and spent some of my supposedly homework time merely lusting over a new and more powerful pneumatic pump-up rifle. My schoolboy income was meager, and my dad decided, on my behalf, that I could not afford the more costly Sheridan .20 caliber. The less flashy and slightly less powerful Benjamin or Crosman 1400 multiple-pump pneumatic in .22 caliber would have to suffice. I still remember that my Benjamin catalog recommended the .22 caliber over the .177 for hunting endeavors. I hoped a switch to the .22 caliber Benjamin would

solve my problem with lack of power/energy.

However, my next airgun was not destined to be a .22 caliber, nor even a pneumatic powered rig. Over a year had passed when my big day finally came (with a little financial help from my dad) when I was persuaded to buy a "hi-power" .177 spring-piston pellet rifle, called the Wischo Bavaria 55, from Air Rifle Headquarters. I had the rifle tuned to shoot at a claimed 800 fps or so. The catalog from Air Rifle Headquarters, along with their salespeople, recommended the .177 over the .22 in a spring-piston rig for hunting. I was reluctant about buying another .177 caliber, but eventually I gambled on the theory that .177 caliber pellets would actually penetrate and expand better than the slower .22 caliber pellets.

Indeed, my new Wischo .177 rig did dispatch varmints better than my less powerful BSA, and it also increased my range a tad. I could dispatch crows out to around 25-35 yards. The new Wischo and I also took on starlings, pigeons, and our infamous backyard rats at a seemingly long-range of around 35-40 yards. Soon after I bought my Wischo pellet rifle I had the good fortune to stumble upon a used Crosman model 160 in excellent condition at a garage sale. My model 160 proved to be accurate, and it became my short to medium-range pest eliminator. Meanwhile, my brother George graduated from his pneumatic powered Crosman model 760 BB/pellet rifle and started shooting a new El Gamo spring-piston rifle in .177 caliber. Between the two of us, we kept most of our neighborhood varmints under control.

Later I started shooting a long awaited .20 caliber Sheridan pneumatic against crows and other assorted small varmints. The Sheridan worked adequately on crows out to around 20-25 yards or so, but with all the noisy pumping involved, one shot on crows seemed to be my limit, unless I waited for a very long time between shots. Then a little later in my life I started shooting a borrowed .22 caliber Beeman R1, then a Beeman R10 in .20 caliber, and next came a Beeman Kodiak in .25 caliber. All of these rigs performed very adequately against the wily crow and other assorted varmints.

Nowadays, when I grab an airgun for crow hunting I prefer to shoot my more powerful air rifles. Contenders from my stable of air rifles include a .22 caliber Theoben Dual Magnum loaded with 21 grain Beeman Kodiak pellets, an RWS 54 in .22 caliber loaded with Crosman Premiers, and a Theoben Eliminator in .20 caliber

loaded with Premier pellets. My reason for selecting air rifles that exceed 19 foot pounds of energy — simply for the sake of extending my shooting range and making cleaner/quicker kills. My .22 caliber “super magnum” RWS CA710T carbine produces a rather impressive 42 to 52 foot pounds of muzzle energy, which makes for a super crow buster. I have cleanly dispatched crows out to around 75-80 yards with this rig.

Which Caliber for Crows?

Tom Hozel wrote an article which appeared in the Oct/Nov/Dec 1993 issue of *U.S. Airgun*



Above, Theoben's unique .22 caliber Dual Magnum gas-ram air rifle. The Dual Magnum can be cocked once for an output of 21 to 23 foot pounds, or cocked twice for an output of 29 to 32 foot pounds of energy. This rifle is sold in the U.S. as the Beeman Dual Magnum.

— Photo courtesy of Theoben Engineering.



Above, the Beeman Crow Magnum IV, a powerful break-barrel gas ram powered hunting air rifle.

— Photo courtesy of Beeman Precision Airguns.



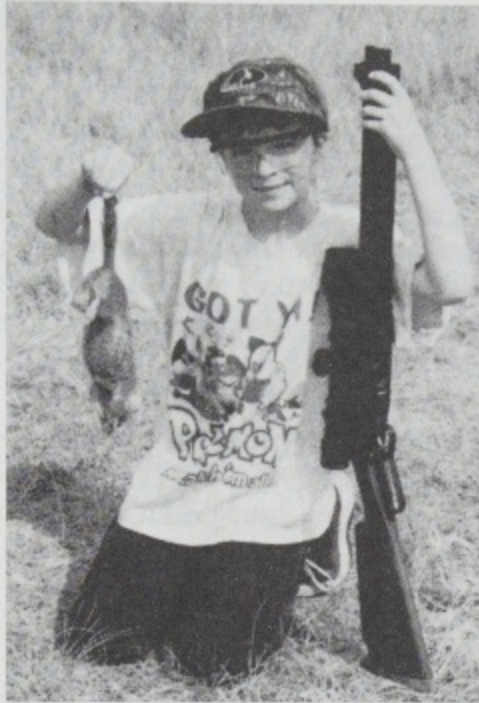
Above, the recoilless Whiscombe JW80, dual-piston air rifle. Top accuracy and high power make the Whiscombe a favorite around the world. — Photo courtesy of Harry Steiber and Pelaire Products.

magazine, titled *Selection of Air Rifle Hunting Caliber*. In Hozel's article he related to having difficulty dispatching crows with a .177 caliber pellet rifle. After some experimentation with shooting .177, .22, and .25 caliber magnum pellet rifles Hozel adopted the .22 caliber as the most effective. Hozel was shooting Beeman laser R-1 rifles in all three calibers. Hozel suggested that his .22 caliber version showed the most favorable combination of both penetration and expansion that allowed the pellet to penetrate the crow's tough chest feathers and still expand for added shock effect.

I agree that most .177 caliber pellets do seem to come up a bit short with shock effect when used against crows. However, I have also discovered that my Kodiak in .25 caliber has shown enough penetration with either Beeman's Kodiak Match or Diana's Magnum dome pellet to quickly stop over 90% of the crows that I shot out to around 40-45 yards or so. Of course, Hozel was not shooting a Beeman Kodiak when he tested the .25 caliber on crows. I would suggest that the extra velocity from my Kodiak over Hozel's R-1 was the reason my .25 caliber magnum was performing with adequate penetration. (Most tests show the .25 caliber Kodiak has approximately 150-160 fps of additional muzzle velocity over the .25 caliber “laserized” R-1). My Theoben Eliminator in .20 caliber and my Whiscombe JW80 in .22 caliber have also shown to be at least 80% to 90% one-shot effective on crows out to around 60-75 yards.

Pushing the Envelope — Long-Range Airgun Hunting

Like many airgunners of my acquaintance, I consider airgun hunting out to around 40 yards as short-range, and out to around 80 yards as medium-range, while anything over 80 yards is long-range. For long-range work I prefer an air rifle that puts out at least 26 foot pounds of energy. Along with my .22 caliber Whiscombe JW80, my .20 caliber Theoben Eliminator has become one of my chosen long-range hunting rifles. The Crosman Premier pellet has proven to work effectively even out to distances of around 100 yards in these two rigs. In fact, the .20 caliber Premier is so aerodynamically efficient in my Theoben Eliminator that it is the exception to my minimum muzzle-energy guidelines for long-range hunting. My other long-range rigs are my



Alan Hanson poses with a ground squirrel taken with a .25 caliber RWS-Career 710T pre-charged air rifle.

new .22 caliber Theoben Dual Magnum (with Beeman Kodiak pellets) and my pre-charged .22 caliber RWS (Career) 710-T with 28.5 grain Korean Dae Sung pellets. Because of a more pronounced loopy trajectory, my .25 caliber RWS 710-T is generally limited to distances of around 70 to 80 yards. My tuned .22 caliber Beeman R1 rifles are used out to a maximum range of 75 to 80 yards, because they only put out around 21-22 foot pounds of energy.

The .25 caliber is rapidly gaining a following with airgun rodent hunters. In my experience, the .25 caliber Crow Magnum pellet and a Beeman Kodiak rifle work very well out to around 40-45 yards, when used against the common ground squirrel. My Kodiak and Crow Magnum pellets were effective slayers even when I missed the head and the rodents upper chest became the target. However, deteriorating accuracy with the .25 caliber Crow Magnum pellet limited my range to a maximum of 45 yards. At distances over 45 yards the .25 caliber Beeman Kodiak pellet or the Diana Magnum pellet became my choice, and I regained enough accuracy to kill ground squirrels with head shots out to around 60-65 yards.

Both of my RWS-Career carbines are frankly somewhat loud, and I lose some of my unobtrusiveness. A few of my shooting buddies helped me conduct an informal decibel test with a couple of sub-sonic loaded .22 rimfire rifles versus

my RWS-Career pre-charged rigs. To our ears the decibel level seemed about the same. However, the Careers gave more of a metallic thud, while the rimfires exhibited more of a crack.

Other pre-charged air rifles that I have experimented with on recent field trips include a .22 caliber Beeman Super 12, and a .22 caliber BSA Super 10, which were putting out around 33 to 35 foot pounds of energy. These two accurate rigs were proven to be capable slayers out to 110 yards or thereabouts. Both of these hunting rigs feature detachable air bottles, which is a feature I think is invaluable for the hunter. The detachable air bottle provides the hunter a convenient method of "recharging" his rifle, so the hunting can continue. Frequently, I am found hunting far out in the so called "sticks" where no dive shops are within perhaps 500 miles, and plenty of extra air bottles are a must. I am seriously thinking about adding one of these high power PCP rigs to my airgun hunting arsenal.

Frontal head shots or back of the head shots are the rule, and I take shots over about 65-70 yards in distance when only a rodent's head is in view; in other words, if more than a frontal head or back of the head appears I don't take the shot. In order to assure a quick and clean kill, I don't wish to risk hitting any part of a rodent's anatomy below the head. In my experience, (with hundreds of rodents) head shots are a hit or a miss



Above, a Richardson's ground squirrel peaking out of its burrow. Photo shows a perfect airgun shooting opportunity with just the rodent's head above ground, which leaves no opportunity for a pellet to impact low and cause a slow death.



Airgun enthusiast Troy Wells shooting his .22 caliber Beeman Kodiak at a steep angle. Troy knows that the vector of gravity on his pellet is reduced when shot at such an angle, and accordingly, Troy aims slightly low on his target.

proposition, and the offending rodent is either killed with a brain shot or eventually escapes my lead barrage and runs for its home burrow.

The main trick to long-range air rifle hunting is to intimately know your rifle's trajectory by actually shooting it at two or three yard increments and noting your pellet's impact. Some shooters tape a trajectory chart to the stock of their rifle for easy field referral. I prefer to pre-memorize my trajectory, but in case of a memory lapse I keep a small pocket sized trajectory card handy for field use. Generally, I zero my long-range rifles at 70 to 80 yards, while my medium range rigs are zeroed at 50 or 60 yards.

Ideally, long-range air rifle hunting is best conducted during very light wind or no wind conditions. We all know that airgun pellets are

tossed around by the wind much more than firearm bullets, which makes airgun hunting that much more of a challenge.

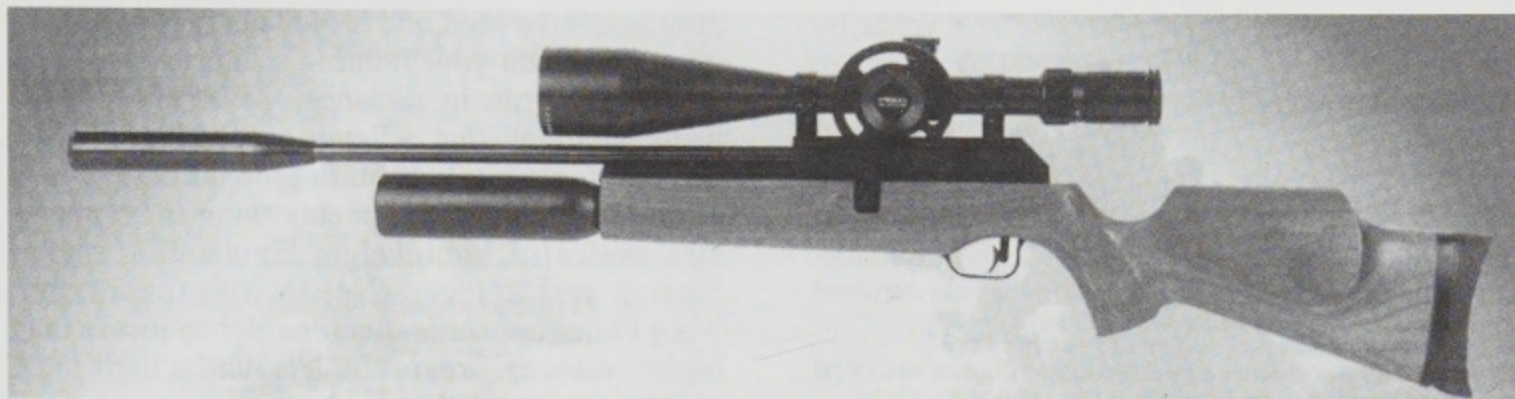
Generally speaking, shooting and hunting with a recoiling piston type of airgun requires a bit more practice to be consistently accurate. Different shooting positions and shoulder contact in the field can equate to missed shots because of the different recoil motion of your gun. Also, when shooting significantly up or down, the vector of gravity on the pellet is reduced, and the result will cause the pellet to impact high. At a range of 100 yards, just a 15° degree angle of deviation will cause your pellet to impact, as if it were 96 yards to the target. See my chart at the end of this chapter.

If you test, and sight in your airgun at say an altitude of 500 feet, then travel to your hunting destination that has an altitude of say 3,000 feet or perhaps 5,000 feet; you have a good chance of missing many potential targets. It is always a good idea to re-confirm your zero and your trajectory as the altitude changes. Depending upon the type of airgun, altitude increases usually have a negative effect on airgun velocity. Multi-pump pneumatics and spring-piston types are affected the most by changes in altitude, while CO₂ guns are temperature sensitive. In fact, some airgunners pack a portable chronograph on hunting excursions for the express purpose of checking velocity changes caused by altitude or temperature variances.

Hunters shooting CO₂ type guns should be aware that at temperatures approaching 100°f the pressure in the system becomes so high that the gun's hammer or trigger mechanism may not have enough energy to fully push the valve open. When this happens, the valve is unable to release as much CO₂ for each shot and velocity will drop. Warning: CO₂ cartridges may explode at temperatures above 160°f (71°C).



Above, a Beeman Super 12 pre-charged air rifle. The Super 12 is available in .20, .22 or .25 caliber and features a 12 shot magazine. — Photo courtesy of Beeman Precision Airguns.



Above, a BSA Super 10 Mk II pre-charged air rifle. This BSA model features a detachable air bottle and a 10 shot magazine, plus enough power and accuracy to keep the airgun hunter happy.

— Photo courtesy of BSA Guns LTD.

As far as the airgunner is concerned, 100 yards is indeed long range! I would say 100 yards to the airgunner is roughly equivalent to 1,000 yards to the long range varmint hunter shooting a hot centerfire cartridge. Actually, this comparison would still favor the centerfire shooter, because most cartridges used at 1,000 yards generally have a good amount of energy remaining upon impact. However, for the airgunner 100 yard energy is usually seriously lacking. Perhaps I can come up with a better comparison.

By chance you might have heard about a handful of early 20th century elephant hunters who preferred smaller caliber rifles, instead of traditional heavy and unwieldy, large bore, hard kicking, elephant rifles. (Hold on here, I am not suggesting that airgunners start hunting elephants.) The most famous was highly regarded elephant hunter — W.D.M. “Karamojo” Bell who used a seemingly feeble (as far as elephant cartridges are considered) 7X57 Mauser, which was called the .275 Rigby by the British. Nowadays, the 7X57 Mauser is considered a basic deer cartridge and probably doesn’t even

rate in the top 100 as a dangerous game rifle. Bell used his 7X57 Mauser because the cartridge recoiled mildly and he was a deadly accurate shot with it, although Bell admitted he was not quite 100% effective with it. Even though Bell’s choice of armament was, in theory, short on energy, he was still able to kill over 700 elephants with his 7X57 because he used solid bullets, which penetrated well, and when he had a pachyderm in his sights he aimed for the brain.

If Bell had used a high power air rifle to effectively kill small varmints around 100 yards, it would have served as an accurate microcosm of his African game hunting. Most long-range airgunner’s armament (like Bell’s) is also in theory short on energy. But also like Bell, the well practiced long-range airgunner is able to use all of his skills and finesse to accomplish his feat and precisely place a well constructed pellet into a varmint’s head. The airgunner only needs enough penetration to reach a vital organ, and the brain shot works the quickest, is generally the easiest to reach, and is the most recommended part of a rodent’s anatomy to aim for.

Tools of the Trade

Again, a small rangefinder will prove to be invaluable in the field. Because airguns have a most loopy trajectory, you must precisely know the range before you can precisely aim your airgun. I have been using various laser rangefinders for years now, and surely recognize their value to the hunter. However, the airgunner doesn’t need a behemoth 1,500 yard rangefinder — it will only hamper your hunt. Your best bet is one of the smaller one-hand units that are rated to range out to at least the 400 yard vicinity. If a particular



Roger Haug shooting author’s Theoben Dual Magnum at 110 yard bullfrogs. Attached to the Dual Magnum is a Bushnell Elite 4200 series 6-24X-40mm with a Mil-Dot reticle.

laser rangefinder is rated, for say, 800 yards by the manufacturer, this rating is generally based on ideal ambient and atmospheric conditions and above average target reflectivity. So to play it safe when choosing a rangefinder, only count on about 50% to 75% of the rated range under most field conditions. Lately, when I hunt with an airgun I have been packing a compact one-handed rangefinder called the Bushnell Scout. The accurate and dependable Bushnell Scout has worked out wonderfully, and I highly recommend it to the airgun hunter.

A hunting scope with an adjustable objective that focuses down to around 10 yards is highly desirable. Remember, if you plan on installing a scope on a spring-piston gun, make sure the scope is designed for use on such a gun; if in doubt check with the manufacturer.

Scopes with customized multiple dot reticles or Mil-Dot reticles also help aid the long range airgunner. A scope with a Mil-Dot reticle has its dots spaced so that each dot-to-dot center is equal to 36 inches at 1000 yards or 3.6 inches at 100 yards. Remember, the Mil-Dot system is usually (but not always) calibrated to be used at the scope's highest magnification. The extra dots down the vertical crosshair aid the hunter by providing additional holdover points, which help the most on repeat shots.

When I am hunting with an airgun and have a distant varmint in view, I have had the best results with high magnification scopes from 16X to about 24X. Scopes in this magnification range may at first seem out of place on an air rifle, but

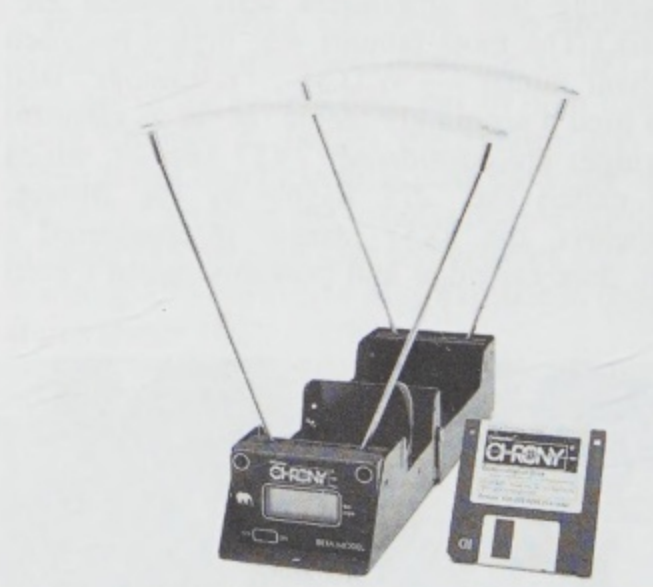


The compact Bushnell Yardage Pro Scout laser rangefinder is a good choice for the airgun hunter. — Photo courtesy of Bushnell Sports Optics Worldwide.

after you have used one the advantages will seem obvious. When your hunting range reaches over about 90 yards in distance, pellet momentum becomes so low that pellet impact and splatter are difficult to precisely spot. In fact, during the heat of battle the targeted rodents themselves rarely take notice of light-weight bombarding pellets landing next to them. (Not so with firearm bullets.) Pellet impact is much harder to locate than higher velocity firearm bullets, and a high magnification scope helps enormously in this regard. A recoilless airgun also helps aid the shooter by allowing him a better chance to see his pellet impact.



The Nikon Buckmasters Laser 800 is another lightweight rangefinder that has provided the author with reliable readings.



It is a good idea for the traveling airgun hunter to pack a portable chronograph like the Chrony pictured above. The chronograph is used to check for velocity changes caused by altitude or temperature variations. — Photo courtesy of Beeman Precision Airguns.

MIL DOT

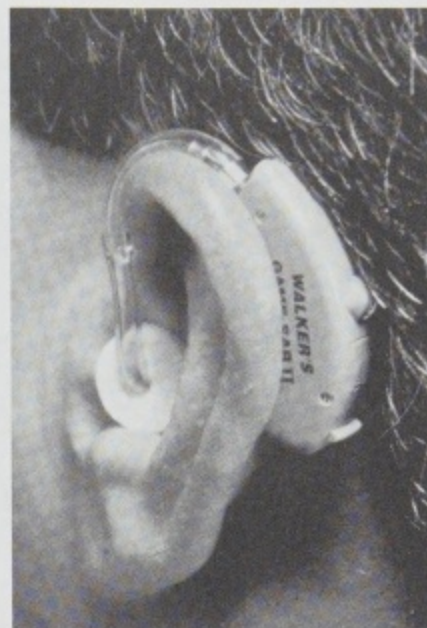


A scope that features a Mil-Dot reticle is a bonus for the long-range airgun hunter.

If you are not shooting a recoilless airgun, it is much more difficult to precisely see your pellet impact, and a spotter using binoculars or a spotting scope is a big help. The spotter's job is to confirm the pellet's downfield impact relative to the intended varmint and pass this information to the shooter. Missed shots at long range are more common than hits, and the airgunner must learn from his misses so he can correct for them on subsequent shots.

Another recently discovered tool has also helped me stalk within airgun range — Walker's Digital game ear. My digital Game Ear can be adjusted to amplify sound, and this feature helps tremendously. By hearing my own amplified stalking noises, I force myself to be stealthier, and therefore my prey isn't as likely to notice me, and I am able to get closer. My Game Ear also allows me to "home-in" on my prey's noises and location easier.

I had the good fortune to have discovered a most noteworthy shooter's harness called "The Steady Aim Harness." Tom Price is the mastermind and promoter behind this shooting enhancement harness. The Steady Aim Harness steadies the shooter in the classic sitting position. This harness wraps the shooter in a padded and very steady shooting position by supporting the shooter's back and legs to form a triangular truss. The Steady Aim consists of a chest harness with a padded back and two padded adjustable knee loops. With the harness on, you simply sit down, flip the loops over your knees, buckle the knee loop connecting strap and you are ready to shoot. This is one of those devices that most shooters don't initially realize the full benefit of, that is until . . . they actually try one on. This harness is so ergonomically designed that Tom Price (while



The Walker's Digital Game Ear has helped the author sneak up within airgun range of many rockchucks. — Photo courtesy of Walker's Game Ear, Inc.



A wind meter or anemometer provides the airgun hunter valuable information about the wind. Above, a compact Davis Turbo Meter.



Author displaying two presently discontinued airguns, a Beeman R10 air rifle and a Crosman SSP-250 CO₂ air pistol. — Photo by Debbie Hanson.



Author took this ground squirrel (and many like it) with a tuned .22 caliber Beeman R1 at a distance of about 60 yards. — Photo by Alan Hanson.

wearing his harness) has actually comfortably watched a full-length movie on TV.

When shooting with my Steady Aim Harness, I have effectively shot both ground squirrels and long-range rockchucks. For the active varmint hunter on the go, this harness is the cat's meow. I figure the harness accounts for at least a 50% increase in my steadiness. I usually use my harness in conjunction with Tom's large hunter cushion, which conveniently snaps on a belt loop when I'm on the move.

Besides hunters, field target enthusiasts are also utilizing Tom's harness. In fact, Tom Price (while of course shooting with his Steady Aim Harness) won both the 1999 Piston Class American Airgun Field Target Association National Championship and the 2000 Piston Division World Field Target Championship.

Tom Price hasn't forgotten the stalking hunter or the predator hunter either, as he also markets a nifty poncho concealment system. This concealment system wraps the shooter in a camouflage blanket, which neatly stores in a detachable fanny pack, and which may also be attached to the Steady Aim Harness. The Steady Aim Harness is available with or without accessory pockets, and you have the choice of two camouflage versions or a plain version. See my appendix under Airgun Gear/Tom Price for more information.

Putting it all together

I've used my Whiscombe JW80 to take ground squirrels out to distances of around 80



Author with his Steady Aim Harness strapped on steadies his .22 caliber Whiscombe JW80 for a long-range shot.



Tom Price and a ground squirrel taken with Tom's .177 caliber TX200 at about 45 yards.

yards with very good results. But generally, I save my Whiscombe for use against the much larger rockchuck (a cousin of the woodchuck). I am most proud of the way my JW80 and my Steady Aim harness helped me dispatch a distant trio of rockchucks. Using my Bushnell Scout rangefinder, I discovered this dastardly trio was partially hiding behind a rock pile at a distance of 108 yards from my position. My Bushnell Elite 6-24X has a Mil-Dot reticle and the extra dots worked out as a real benefit. I carefully placed my lowest dot at the top of the chuck's head and allowed several inches for windage as well. With my scope magnification cranked up to 24X, I could easily see my pellet impact a few inches left of my chosen target's head and bounce off a rock. By taking my time and concentrating on pellet placement with the help of my Mil-Dots, I kept making windage adjustments until I was able to lob a lethal pellet into each chuck's head. All three chucks died quickly, and were found within a few yards from where they were shot. (Note: presently my Whiscombe JW80 has a Mil-Dot equipped Tasco Tactical 8-40X56mm attached.) These chucks seemed clueless about what was going on, probably due to the low noise and lack of any significant impact disturbance from my missed shots. If I was shooting an actual firearm, it would be a good bet that I would have only been able to fire one or two shots before the chucks would have become spooked and escaped.

Caliber Selection

As I have mentioned before, the first choice among airgunners for use against rodents is usually a .22 or a .25 caliber. The .177 is usually considered as a last choice, as far as caliber selection goes. Indeed, larger caliber pellets inflict more tissue damage and let in "more sunlight". Larger caliber pellets generally create a larger wound channel, which causes more shock. The cross sectional area of a .177 pellet is 0.0246, while the .20 caliber measures at 0.0314 and a .22 caliber comes in at 0.0396. These numbers show that the .22 caliber owns a 60% greater cross sectional area over the .177 caliber.

Most airgun hunters, if they had their druthers, choose a caliber larger than .177. However, I know of several hunters who do quite well with their .177's. Take championship field target shooter Tom Price, for instance, and his well-tuned fourteen foot pound .177 TX200. Tom shoots his selected air rifle just about every day, as the two of them are just about inseparable. Tom has shot his championship TX200 so much that its trajectory is second nature to him. When Tom Price goes critter shooting, he is well aware of the fact that his TX200 is lacking in the energy department, and he simply opts for head shots. I have seen Tom cleanly take ground squirrels with Crosman Premiers out to around 40-45 yards with head shots.

Another method that some airgunners use is to hunt and shoot in tandem. Tandem hunting requires the shooters to both focus upon and shoot the same critter almost simultaneously. The targeted varmint receives a quick one-two



Author shooting his .22 caliber Whiscombe JW80 at ground squirrels out to around 80 yards. Firearm shooting was not allowed here, but airguns were acceptable. — Photo by Alan Hanson.



Author holding a rockchuck taken with his Whiscombe JW80 at a laser ranged 108 yards!

punch and generally dies quicker and has less chance to make an escape. I used this technique when shooting short-range ground squirrels last year with my ten-year old son Alan. Alan was shooting his tuned Beeman R7, and when Alan let loose a 7.9 grain Premier pellet I quickly shot the same squirrel with my .177 caliber RWS model 54, which was loaded with Beeman Crow Magnum pellets. Our targeted rodents died nearly instantly, as the squirrels buckled over on the spot from our quick double shots.

Regardless of airgun caliber, knowing your gun and becoming familiar with its trajectory is the prime prerequisite before hunting. One of the "problems" with being a gun writer is that I am consistently shooting a variety of guns, both airguns and firearms, and as a result I don't usually have the opportunity to become intimately familiar with a gun's trajectory. Most of the time, when I have acquired a passing familiarity with an airgun's trajectory, it is then time to move on

to another gun of some sort and start the process all over again. This lack of familiarity with the .177 caliber as far as a hunting tool is my downfall. If I ever get the chance to really use a .177 caliber consistently and discover its secrets, I have the feeling I will get better results than I am getting now.

Kinetic Energy and Airguns

During the early 1980's it became common knowledge that any airgun with an output of at least 12 foot pounds was considered a magnum airgun. In England, any airgun with 12 foot pounds of kinetic energy is considered a firearm, and a special FAC license is required. As a result, most British airgunners simply use sub-magnum airguns for the bulk of their hunting requirements. British airgunners generally limit their hunting activities to around 40 yards, and a 50 yard shot would be considered a very long shot indeed. (The Canadians are also hampered with a law that limits airguns to 500 fps regardless of caliber or pellet weight!)

Nowadays, most American airgun hunters consider a 12 foot pound gun as a little on the light side. As a general guide, most .177 caliber airguns top out at around 20 foot pounds of energy. However, there are a couple of new spring-piston models (RWS 350 Magnum and Gamo 1250) that will amazingly put out around 22 to 25 foot pounds of energy. The .20 caliber generally tops out at around 26-29 foot pounds, while many .22 and .25 caliber models will reach over 30 foot pounds. Many airgunners I know have attached the moniker "Super-Magnum" to airguns that put out over 30 foot pounds of energy.

Personally, if I were considering moving up to a more powerful airgun for hunting purposes, the new gun would have at least 3 to 4 additional foot pounds of energy. Anything less than 3 to 4 foot pounds would not be significant enough to make much of a difference. Taking this theme one step further, I would say that once you have reached about 30 foot pounds of energy, anything less than a five or six foot pound increase will most likely go unnoticed in the field.

Long-range airgun varmint hunting is not for every "Joe" who shoots an airgun. This specialized type of hunting is recommended only for the most disciplined and practiced shooter. A very

accurate and powerful air rifle is also required, and the shooter should have a very good feel for the trajectory. If you are willing to put out the extra effort, give long-range varmint hunting a try. However, once you have completed an enjoyable and successful hunt you just might find that it is contagious.

100 yard - Uphill/Downhill shooting correction chart -

Degrees	Yards correction
0°	100 yards (no correction)
5°	99 yards
10°	98
15°	96
20°	94
25°	91
30°	87
35°	82
40°	76
45°	71
50°	64
55°	57



Airgun hunting in tandem with predator calling should be done with extreme caution. Above, (in cartoon form) the author's son, Alan, commenced to blow his dying rabbit call during a break from an air rifle ground squirrel hunt. Low and behold a curious black bear soon appeared and attempted to locate the "injured rabbit"! Luckily, the author fired his handgun in the air to frighten the bear, and nobody was injured. — Cartoon by Oscar Davis.

CHAPTER FIVE

American Field Target



Who would have known years later that a British born air rifle silhouette shooting game called "Field Target" would become popular in the United States? Field Target has helped popularize the airgun culture tremendously with new clubs and members joining in the fun with every coming year. The general atmosphere and camaraderie of Field Target is more relaxed than most other types of airgun competition, and this has helped with sustaining memberships and accepting new shooters.

This type of metallic silhouette competition uses painted steel targets in the configuration of various animals. Some of the animal targets that I have seen were figured after: opossums, crows, small-birds, squirrels, rats, turkeys, rabbits, pigeons, woodchucks, frogs, snakes, and chickens. More often than not these targets are vividly painted, and are placed (usually in a wooded environment) at various undisclosed distances from 10 yards to about 55 yards. These animal targets have a mid-animal hit-zone that is painted a bright color (red or orange), and when hit by a pellet it knocks the entire target over. A cord is pulled from the shooters location to easily reset the target. The small circle sized aperture of the "hit-zone" varies in size from $\frac{3}{8}$ " to $1\frac{3}{4}$ ". Some

targets even have an adjustable hit-zone which easily allows the Match Director the flexibility to change the difficulty level of the course. The average distance to the targets generally hovers right around 30 yards. The Match Director of course has the authority to increase the target distance as the shooters gain proficiency.

The sitting position is by far, the most common shooting position in Field Target, although sometimes the targets are placed strategically so that you can't see the "hit-zone," unless you are standing or perhaps kneeling. Shooters are placed in squads of two or three and each take their turn at shooting, scoring, and resetting targets. Usually, two shots are taken at each target. One point is scored for each knocked down target. If you hit the face of the target, but not the hit-zone (sometimes called the sweet spot), it will not fall over and is considered a miss. A miss counts for zero on the shooter's scorecard. Remember, your pellet can't touch the edge of the hit zone or you will have achieved what is known as a splitter, and the field target will not fall.

The shooter with the most points at the conclusion of the course wins the match. It is great family fun, while enforcing the basics of good gun handling and safety practices. It also teaches



Kyle McCormack, left center, field target match director for the Tacoma Rifle & Revolver Field Target Club, (TRRFTC) reiterates his safety rules before a monthly match.

the shooter the importance of range estimation, wind deflection, target concentration, and trigger control.

Clubs routinely divide the contest into at least two divisions which are pre-charged pneumatic, and spring gun. Remember, most shooters don't shoot a spring gun as consistently and the scores are usually a bit lower, hence the reason for a separate division. Sometimes the Match Director will add other categories as needed, such as modified spring gun, or perhaps a junior division.

Currently pre-charged pneumatics seem to possess the most appeal by veteran Field Target shooters. While tuned spring-piston air rifles are generally accurate, they require more shooter technique, concentration and practice for the utmost in consistency. However, just because you may be shooting an expensive pre-charged rifle, don't automatically assume that you will win a Field Target match. Familiarity with your equipment plays a large part in the equation for success, and many well practiced spring gun shooters have won matches despite being the underdog.

Scopes for Field Target

Sophisticated variable magnification scopes that feature extended focusing down to 10 meters are commonly seen clamped to air rifles that are destined for field targets. The newcomer to Field Target may wonder why the trend towards huge high magnification scopes. Ten to twelve years ago the top-end scopes, magnification-wise, were hovering around 20X to 24X and only occasionally to 32X. Nowadays, the top-end scopes are in the 50X to 60X range, with the average at about 32X. Since the shooter does not know the exact range to the target and separate rangefinding devices are illegal, the shooter must use a high magnification scope and use the adjustable objective feature to focus on the intended target, thereby giving the shooter a means to estimate the target distance.

Some shooters also use a strip of white tape that is used to cover the factory adjustable objective distances, and precise distances are marked on the tape after distance measurements are taken. After the shooter checks the target distance by cranking up the magnification on his scope and focuses the adjustable objective to the range, he/she usually adjusts the magnification down to perhaps 32X or 24X before actually taking the



Above, three examples of high magnification scopes commonly seen clamped to field target air rifles. Top to bottom: BSA Platinum Big Wheel 6.5-26X-52mm AO, Bushnell Elite 4200 8-32X-40mm AO, Tasco Tactical 8-40X-56mm AO. All these scopes focus down to 10 yards, which helps to make them airgun friendly.

— Photos courtesy of the respective manufacturers.

shot. The shooter then checks his range to scope adjustment chart and cranks in the proper amount of scope elevation that corresponds to the estimated range. For simplicity, some shooters use a larger aftermarket scope elevation knob that is correspondingly setup with distance markings, which must be configured by shooting and measuring. With this setup the shooter does not need to count and keep track of scope elevation clicks, so there is less chance of making an error.

The shooter then must rather quickly estimate the wind and hold off the target (if necessary) via "Kentucky" windage to compensate for wind deflection or use the scope's windage adjustment. Some shooters use a dangling feather or a strip of



Dottie Berry shooting a tuned Beeman HW77 during a match.



Karin Sutherland, with the help of her Daystate CR97 and a BSA 10-50X-60mm scope, knocks down another target, then smiles for the camera. Karin won the "High Lady" trophy during the 2000 World Championship match.



Debra Grim from the United Kingdom, takes time-out from a match to smile for the photographer. Debra was shooting a Ripley AR4 topped off with a Leupold scope.

mylar tape that is fastened near to the muzzle as an aid for determining the wind's force. Although lately I have seen a few field target shooters experimenting with various wind meters for more precise "Kentucky" windage.

Personal shooting style

Since I am a varmint hunter first and a field target shooter second, I prefer *not to use* my scope's elevation adjustment or windage adjustment. After I estimate the range with the scope's adjustable objective, I simply use the method that most hunters practice, and simply hold over (or under) the field target's hit zone — while using my best educated guess as to my pellet's trajectory, and then I take my shot. I am well aware that this method will cost me a slightly lower score, but I figure the practice, while using this method, will pay dividends when it comes to actual hunting.

Also, not following most traditional shooters, I have selected to shoot .20 caliber as my first choice. My reasoning comes from the fact that the .20 caliber Crosman Premier usually shoots with the highest ballistic coefficient, which means less wind deflection. However, it also means I shoot with a more pronounced trajectory, because the Crosman Premier is a heavy pellet, and my velocity is lower than almost all of the .177 caliber shooters. If my plan fails, or I start to crave a little experimentation, I will simply switch to my Whiscombe .177 caliber barrel on my JW 65 and shoot 10.5 grain Premiers.

I had the privilege to witness and photograph the 2000 World Championship match hosted by MAFTA (Minnesota Airgun Field Target Association). The competition was fierce and equipment problems seemed to be fairly common. The most prevalent problem among the shooters with pre-charged guns seemed to evolve around their regulators. Many shooters came over to Joe Korick to see if he could correct problem regulators, but unfortunately Joe didn't have his diagnostic equipment with him. The second most common talked-about problem centered around scopes that were not tracking properly.

For now, I am most comfortable shooting a spring-piston rifle, but that could change in the future. My very accurate Whiscombe JW 65 is most likely more accurate than I can shoot it, and with this rig I don't need to mess around with a scuba tank and all the associated equipment. I predict that pre-charged guns suitable for field

target will become more reliable and stable in the future and prices may also start to drop and, when this time comes I will be ready to pounce on a new PCP rig for Field Target.

As Tom Gaylord pointed out in his December 2000 *Airgun Letter*, if you intend to correctly use your scope's elevation adjustment you will need to have it optically centered for the best results. Out of the box, a new scope should be mechanically centered, but it may not necessarily be optically centered. If your scope is not optically centered, it will not precisely track in a vertical plane, and most likely your pellets will veer off a bit to one side as you raise or lower the elevation adjustment.

To check for an optically centered scope, a technician would put the scope in a special collimator and perform a series of tests. However, the average shooter will not have such a device and will have to make do with a secure V-block setup. (Extra high rings also work, if you have enough clearance for scope rotation, just loosen the rings enough to allow scope rotation and use a scope bore sighter). Next, you fully rotate the scope around a complete circle, while noting the reticle's alignment on a draftsman $\frac{1}{4}$ " grid pattern. This grid paper should be at least 10 yards in distance, but 20 or 25 yards will be even more precise. The goal is to eliminate as much extraneous reticle movement as possible by adjusting both the elevation and windage. If possible, keep adjusting until the reticle's rotation stays inside a $\frac{1}{4}$ " grid at 20 yards or a $\frac{1}{8}$ " grid at 10 yards. I have generally found that high quality scopes out

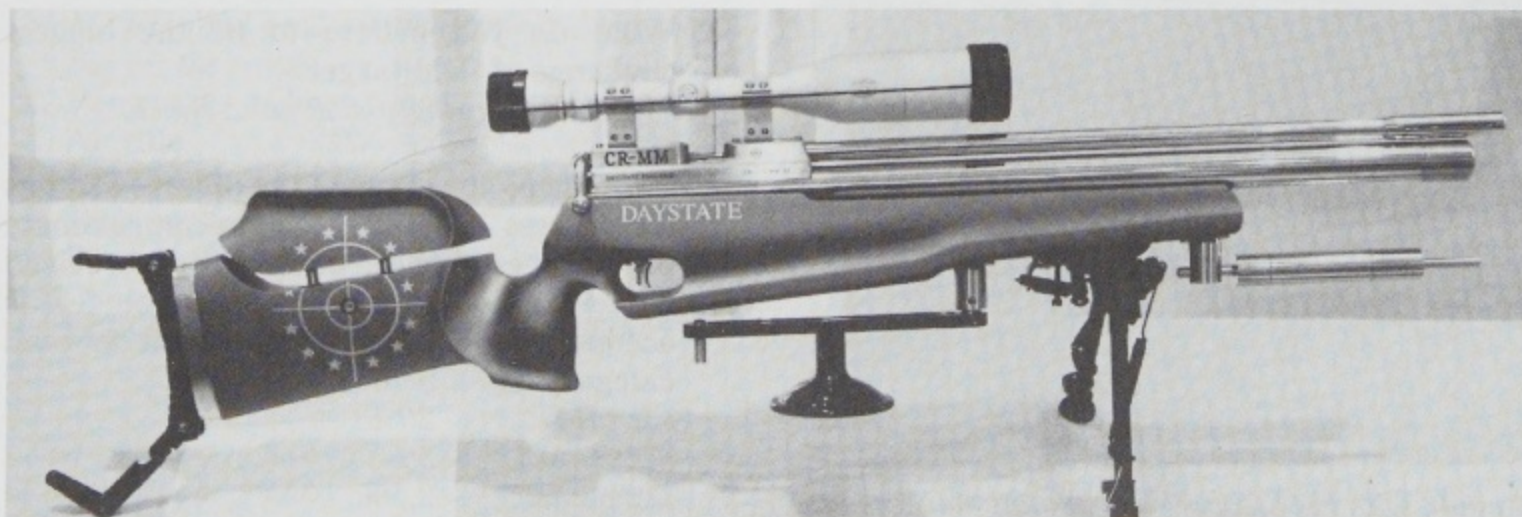
of the box are not far out of alignment, (in fact some tested near perfectly) and are quick to adjust. The final process is to keep your scope's adjustments intact and mount your scope using an adjustable mount, while sighting in using only the mount's adjustments and not the scope's.

Field Target Airguns

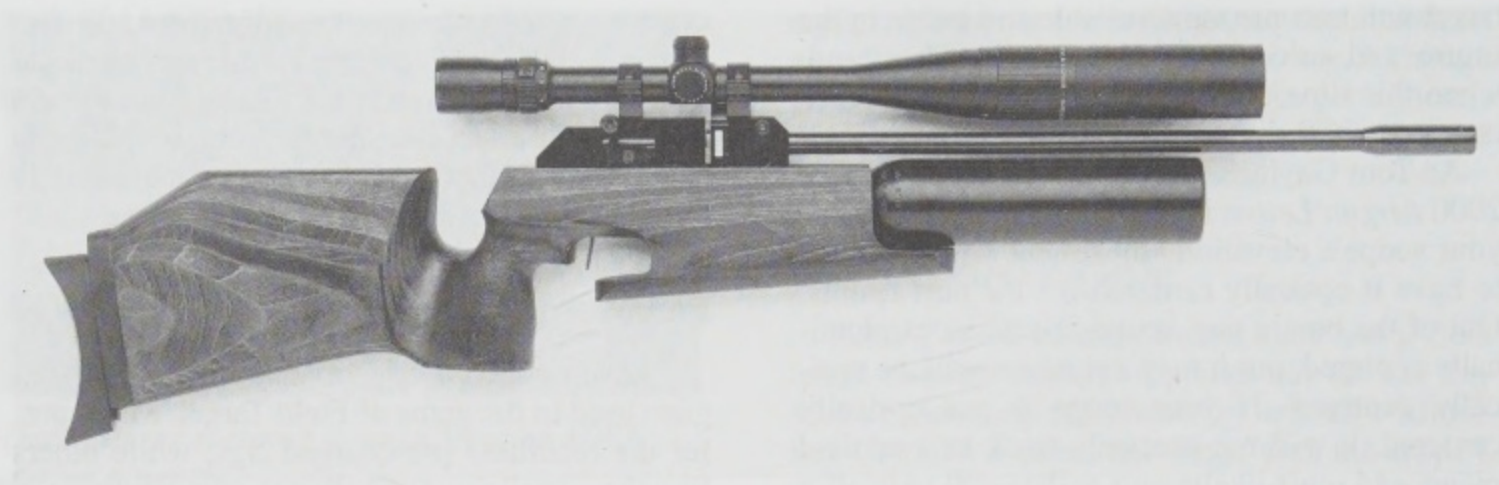
I have noticed a very diverse selection of airguns used in the game of Field Target. Many prefer the recoilless pre-charged rigs, while others like the simplicity or challenge of a spring gun, which does indeed give simplicity of operation, but which is considerably more challenging to shoot well. Some shooters also have their favorite brands much like some drivers may favor a Chevrolet, Ford or perhaps something exotic like Jaguar or Porsche.

Some of the frequently shot pre-charged guns include: Air Arms RN10, Air Arms Pro Target, Air Arms NJR100, Air Arms SM100, Beeman Mako, Daystate CR97, Daystate CR94, Daystate Huntsman, Daystate LR90, FWB P70, Ripley AR5.

Some of the frequently shot spring-piston guns include: Air Arms TX200 and the discontinued TX200SR, Air Arms Pro Sport, Air Arms Pro Elite, Beeman's HW97, and HW77, Beeman R11/HW90, Beeman R1/HW80, Beeman R9/HW95, the discontinued Beeman/FWB 124, RWS models 48, 52, 54, and 46 recoilless, Whiscombe models JW75, JW65, and JW60 and the discontinued recoilless Park models RH93 and RH91.



A look at Daystate's exquisite CR-MM field target designed pre-charged air rifle.



Above, the pre-charged Beeman Super 17FT is another example of the advancing evolution of more sophisticated and accurate air rifles. The Super 17FT was designed for field target and features a 17-shot magazine and an interchangeable 400cc air bottle. — Photo courtesy of Beeman Precision Airguns.

Airguns with an energy output of less than 10 foot pounds are not frequently used because they don't reliably knock down field targets. In fact, all field targets are not equal, and for whatever the reasons, (degree of wear and tear, out of perfect adjustment, degree of lubricity, ground angle, etc), some field targets are not always knocked down consistently at long range with 12 foot pound airguns, despite being hit with perfectly centered shots. For this reason, I (like many other shooters) tend to favor an airgun with an output of at least 14 foot pounds of energy.

There are numerous reasons why some field target shooters consistently shoot higher scores. In order to get a possible consensus on why some shooters knock down more targets, I sent out a questionnaire, and the shooters who replied are



Author, with his Steady Aim shooting harness strapped on, prepares to shoot his Whiscombe JW65 during a field target match. — Photo by Alan Hanson.

featured next. I discovered the reasons for success are very diverse, complex, and difficult to pinpoint.

Tom Price, Winner of the 2000 Piston-Class Field Target World Championship Match, replied:

1. What equipment are you using for field target? (Rifle type and brand, caliber, pellet brand and type, scope brand and magnification, and anything else that comes to mind.)

"Air Arms TX200 Maccari MkIII in .177 caliber, I shoot 7.9 grain Crosman Premier pellets, and use a Burris 8-32X44mm scope."

2. Do you have a designated backup air rifle for field target? If you do, please describe your backup equipment.

"Air Arms TX200 Maccari MkIV, I shoot 7.9 grain Crosman Premiers with another Burris 8-32X44mm scope."

3. What do you believe to be the biggest challenge of field target?

"Wind, and spring-piston hand shock."

4. I am trying to correlate the diverse reasons for success in field target to approximate percentages. Please place your perceived percentage of importance that you feel is accountable to your success next to each category listed below.

Air rifle	20%
Scope	5%
Technique	2.5%
Practice regime	10%
Chosen pellet	2.5%
Miscellaneous	60% (the Steady Aim Harness)



Tom Price steadies his TX200 for a long 55 yard shot through the evergreens.

Steve Cox replied:

1. I'm shooting a Whiscombe JW-65FB rifle, in .177 caliber, with .177 Crosman Premier 7.9 grain pellets. The scope on top of the rig is a Burris 8-32x.
2. My backup rifle is another Whiscombe, but this one is a Model JW-65BB in .20 caliber, firing .20 Crosman Premier 14.3 grain pellets.
3. My personal greatest challenge is compensating for the wind.
4. Percentage of Importance:

Air rifle	25%
Scope	25%
Technique	5%
Practice regime	5%
Chosen pellet	20%
Miscellaneous	20% (Familiarity with trajectory)

There are many fine rifles, which will serve well. Premiers are nearly the universal pellets of choice. However, rangefinding (scope dependent) and knowledge of trajectory and wind are critical.

Shooter Bobby Corcorran replied:

1. I use a Daystate Huntsman rifle in .177, Crosman Premier 10.5 grain, Bausch and Lomb Elite 8x-32x w/40mm objective scope, scope level, and elbow pad. Sandy uses a Theoben Rapid 17 rifle in .177, Crosman Premier 10.5's, B&L Elite 8x-32x w/40 mm objective, scope level and knee pad. Both of us use Bum bags (sit pads). I also use Bob Winer's ballistic program for trajectory and windage computations.
2. We share an Air Arms Pro Target rifle in .177 w/B&L Elite 6x24 40mm for backup rifle. It uses Crosman Premier 10.5's.
3. The biggest challenge that we both deal with is the tendency of the air rifles to wander in their zero from beginning to end of the charge. I've not personally shot a rifle that is stable enough for a 100% score at the difficulty level that most of our matches are. I've shot many that were accurate enough in small samples. Having said that, the World Championships seemed within the capability of several of the better rifles I've used. If equipment were not the big challenge, next would be the wind. Pellets are affected to a great degree by the wind and it is sometimes difficult to tell what is happening over the short range at which the matches are shot.

4. Percentage of importance:

Air rifle	30%
Scope	20%
Technique	20%
Practice	15%
Chosen pellet	5%



Rodney Boyce, field target pioneer, airgun writer and editor of various airgun publications, steadies his Daystate CR97X for a distant target. Atop of Rodney's rifle is a Burris RA 8-32X scope.



Ray Apelles (Co-owner of the "A" team) shoots his FWB P70FT with a NightForce 36X scope attached.



Junior shooter Alan Hanson, steadies his Ken Reeves tuned, Beeman R7 on a field target. The Beeman R7 in .177 caliber serves as a good beginner's field target rifle, but lacks the necessary velocity to consistently knock down distant targets.



Lloyd Marquardt ranging his scope on another distant field target. Lloyd shoots a customized Anschütz ZM 2002.

Miscellaneous 5% (Familiarity with pellet trajectory)
5% (Familiarity with rifle quirks, misc)

I asked field target shooter and maker of field targets **Ron Juneau** the following:

What equipment are you using for field target? (Rifle type and brand, caliber, pellet brand and type, scope brand and magnification, and anything else that comes to mind.)

"HW77 with a Venom Kit, completely tuned, homemade adjustable stock, Leupold 6.5-20X scope. I shoot 7.9 grain Crosman Premiers."

Do you have a designated backup air rifle for field target? If you do, please describe your backup equipment.

"TX200 (Air Arms), Leupold 6.5-20X, and the same 7.9 gr. Crosman Premier Pellet."

"My choice to shoot in the piston class is based on the following factors.

1. Spring Guns are less temperamental than pre-charged guns.
2. More challenging - shooting a high score in this class gets respect.
3. Budget concerns- costs half as much as most pre-charged rigs and the price is less intimidating to newcomers who are thinking about entering the sport."

I am trying to correlate the diverse reasons for success in field target to approximate percentages. Please place your perceived percentage of importance that you feel is accountable to your success next to each category listed below.

Air rifle	20%	An accurate rifle that fits the shooter is essential for confidence.
Scope	10%	Good quality-capable of range-finding at longer distances, and repeatable.
Technique	5%	Important, but for me, not as much as other components.
Practice regime	20%	Unlike stamp collecting, you can't put this sport down and pick it up months later.
Chosen pellet	10%	Consistent weight and shape is important – one that cheats the wind.

Trajectory	15%	Especially important at extended distances, when pellets nosedive.
Miscellaneous	10%	Follow through- essential when using a recoiling spring gun.
Mental Control	10%	Feeling rested, confident with equipment & preparation, and not getting upset with oneself when you miss a "gimme" shot.

Ron Carlson, Winner of the 2000 Field Target World Championship Match, replied:

"I am still using an Air Arms Custom 100 (pneumatic or pre-charged). It was a Model SM-100 when I purchased it in 1993 and made the necessary changes that updated it to the same as an NJR. My reason for purchasing the SM-100 was that I wanted to build my own stock. It is a .177 caliber; I do not want any more split pellets.

I use Crosman Premier 10.5 grain pellets, which are totally submersed in FP-10. I do not clean nor weigh my pellets.

My scope of choice is a Nightforce 36 X 56, however, I started to experience problems with that scope about 2 weeks before the tournament. Then, two days before the tournament I purchased a Burris 8-32 X 40 Rim Fire/Air Rifle scope, which remained at 32 power throughout the tournament. I sighted it in on the day before the tournament. 45 yards and over are a little more difficult to range with the Burris.



Top spring-piston shooter, Charly Bussom, lines up another field target and steadies his custom stocked TX200 SR and knocks over another field target.

I do use a shooting jacket and a cushion that is at the 6" limit for height. The jacket was very hot to shoot in but I have been unable to make the body strap work for me.

I do not have a backup rifle of any kind. If you know your rifle well enough, you should be able curtail the possibility of any failures. There is an old saying, "**Beware of the One Gun Man**".

"**Concentration**", the only thing that interrupts my shot is someone saying my name and the words "cold line"; other than that I seem to block out everything.

I will put your list in the order I feel that they are of importance to me. **Technique**, is number one in my mind.

Practice regime, I get to the practice range at least once a week. I practice at very small kill zones so that I remain confident regardless of the target setup. So many times I have heard individuals say, "This is a tough one." Be assured they will miss it.

Pellets, are by far the most important part of airgunners equipment. In the past, the shooters from England would go to the manufacturer and check each batch of pellets produced and when they found a good one, they would buy the whole batch.

Air Rifle, in your mind you must believe that you have the most accurate rifle in the world.

Scope, yes you have to have a good scope but there are a large number of brand named scopes that make the winners circle.

Familiarity with Pellet, Not too much of a factor in this country with the 20 ft. lb. limit. It has been a long time since I held the reticle out of the kill zone.

I do feel that we in the U.S. shoot a completely different game than the shooters from the U.K.



Dave Gere, shooting his customized FWB P70FT during a match. Clamped to Dave's rifle, (using his own designed mounts and rings), is a BSA 10-50X-60mm Big Wheel scope.

We play an accuracy game while they play by the clock. When we go over there to compete, we feel like a fish out of water, two targets per lane, one shot at each in a two-minute time limit. Their kill zones are approximately 25mm = 1" & 40mm = 1-1/2" where ours vary from 3/8" to 1-1/2" with no clock running. I am sure that U.K. shooters were as uncomfortable with our game as we are with theirs. It is my hope that some changes can be made that will make the game more compatible for both."

The governing body for Field Target in America is AAFTA — American Airgun Field Target Association. A monthly newsletter is published which lists every Field Target club plus a contact person. The newsletter gives highlights and scores of most of the clubs shoots around the country. The newsletter also features technical



Above, an enthusiastic Joe Korick, of Pneumatic Engineering, shows off his new Daystate CR-X and BSA 10-50X-60mm Big Wheel scope.



Roz Sumpter concentrates on a tricky field target, while he steadies his custom stocked TX200.

articles from time to time and lists airgun equipment suppliers. Contact AAFTA if you care to subscribe. The climax to a Field Target season is the National Championship, or the World Championship. These large Championship matches are designed around a two or three day course and eager shooters from around the world come to compete.

The following Field Target rules and commentary was provided courtesy of AAFTA:

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American Airgun Field Target Association The Sport and its History

Field Target shooting got its start in the early 1980's when a handful of British airgunners attempted to create a new sport to simulate hunting with an airgun. Metal targets in the shape of typical airgun quarry were placed at typical airgun hunting distances. A paper target was placed on the kill area of the animal. Competitors shot at the target and then a judge went down to score the hits and replace the paper kill zone. This worked well when there were only a few shooters. As the sport grew, the interruption caused by going downrange to score each competitor was limiting. Using a target that could be reset from the firing line with a cord sped up the scoring process, thus allowing more shooters the fun of shooting. The fact that the 1/8" plate steel targets sounded and fell back when hit added immensely to shooter satisfaction and spectator appeal. Shooters began customizing their favorite airguns and the technology race was on! Gun manufacturers began to claim that their modifications were just what the field target shooter needed to get "one up" on his competition. From this race was born a new breed of airguns; guns that would shoot very accurately at ranges of 50 yards, and with adequate power (maximum 12 foot pounds due to English government regulation) to knock down those metallic targets. Today, thousands of



Mike Reynolds enjoys his new pre-charged Daystate Harrier. Mike's rifle has a bit of a twist, as it is stocked with a (Daystate) Huntsman stock. A BSA Big Wheel 10-50X scope completes Mike's rig.

British airgunners travel all over England every weekend to compete in field target matches, a very "Informal" version of precision match shooting. Field target shooting came to the U.S. in the mid 1980's, appearing almost simultaneously in California and Florida. Florida hosted the first U.S. Championships in 1987, in West Palm Beach. This match was so well accepted that a small hard-core group of airgunners formed the AAFTA (American Airgun Field Target Association),

The AAFTA, which produces a monthly newsletter, is now helping to spawn new clubs all over the U.S. and Canada. In the U.S. shooters are squadded in random groups of three. Each squad starts on a lane that has been appropriately marked in the woods or fields. One to three targets will be located down each lane at random distances. Each shooter takes a turn firing once or twice at each target. He alone must estimate the range of each and be so familiar with his airgun's trajectory that he is able to hit the target's "kill-zone". Skill plays a much more important role in shooter success than the power of his airgun. Only if the target face falls is a point scored. Local matches typically consist of 30 to 60 shots per shooter, while regional or national matches usually consist of 100 or more shots over two days. The emphasis is placed on encouraging and getting to know your squad members, as well as other competitors. The competition has a definite air of informality, as the competitors are more attuned to improving their own performance, rather than competing directly with others. Shooting is done "freestyle", that is, any position is allowed, as long as the gun is supported by the hands and body only. The "open class" utilizes traditional shooting positions.

Most prefer the sitting position, with the gun laid over the arm or resting on the knee, while sitting on a cushion. The name of the game is "precision". Only the best pellets will give the results needed to make the long shots (as far as 55 yards) or short shots on reduced kill zones. These generally measure 1-1/2", with some at 1", and a few at 3/4", 1/2" and 3/8". Shooting distances vary from 10 to 55 yards, with an average of 30 yards overall. The groups that some of these shooters produce would startle even some benchrest shooters! The rules of field target shooting are few, and are regulated only by the AAFTA. Local clubs are encouraged to create many classes to reward shooters at all levels. Even regional and national competitions include enough classes to allow everyone to compete for awards. Just remember, the object of field target shooting is involvement and camaraderie. Whether or not you ever desire to compete in regional or national matches, you can enjoy this new sport with your club or just a few friends in a safe



John Whiscombe displays his personal JW65, which is topped off with a Tasco Custom Shop 8-40X scope.



Top United Kingdom shooter Andy Calpin poses with his Ripley AR-5S and Tasco 10-50X scope.



Ron Carlson, left, and Tom Price are presented their 2000 World/U.S. National Field Target Championship trophies in Minnesota. Ron was the Open division champion and Tom was the Piston division champion. Someday field target competition may be granted Olympic Class status and become even more popular throughout the world.

shooting location. The most important thing is to enjoy airgunning by shooting as often as you can. Good shooting!

Author: Jack Kirkendoll

SHOOT RULES

1). Airguns:

- A). Any safe airgun of any configuration, shooting a single pellet.
- B). Any airgun declared unsafe to people and/or property (including targets) by the Match Director will be barred from use. (revised 10/98)

2). Sights:

- A). Any form of sighting system may be used.
- B). No separate device designed specifically for or used for range finding may be used to view the targets.

3). Ammunition:

- A). Any design of pellet that is completely constructed of lead or lead alloy only.

4). Targets:

- A). Silhouette fall-when-hit targets resettable from the firing point will be used. Silhouettes should be of typical airgun quarry.
- B). Targets should not be closer than 10 yards, nor further than 55 yards from the firing point. (revised 4/00)
- C). The Match Director should assure that shooting lanes and physical limits of the firing points are clearly defined.
- D). A clear and unobstructed view of the hit zone must be afforded from at least one shooting position. (revised 4/00)
- E). Shooters may reset their own targets once they are given permission from the scorer. (revised 1/98)

5). Scoring:

- A). Scoring shall be on the basis of one point for each "hit" and a zero for each miss.
- B). A hit will be awarded when the target falls, any movement of the kill zone paddle which does not result in the target face plate falling will be recorded as a miss. (revised 4/00)

- C). Any discharge without first announcing one's intention to deliberately discharge the gun [into the ground] shall be recorded as a miss. (revised 4/00)

6). Shooting Position:

- A). Any shooting position is allowed but the range may be set up to necessitate use of a forced position on some targets.
 B). Rifle slings may be used.
 C). No form of support from the ground for the airgun and/or body may be used (e.g., bipod, benchrest, chair, tree stump, etc.).
 D). A seat/prone mat used solely as a seat/mat may be used (see Rule 7).
 E). The airgun must be supported by the shooter's hand(s) and body. (revised 10/98)

7). Seating:

- A). The maximum height for any form of seat is 6 inches, measured with the shooter sitting on the seat.
 B). The six inches is measured from the ground to the highest point of the seat.
 C). The seat can only be used as a seat and not any other means of shooting support.

***Note:** Variations of Rules 6 & 7 may be applied at the discretion of the Match Director in recognition of shooters' desires, while ensuring that no unfair advantage is accrued. In the event an advantage is obtained, those shooters shall compete in a separate class for awards. (revised 10/98, 4/00)

8). Disputed Scores:

- A). Any challenge must be made to the Marshal prior to leaving the target.
 B). Any dispute not resolved at that time will be referred to the Match Director, whose decision will be final.

9). Penalties:

- A). The penalty for deliberate infraction of Shoot Rules, unsafe practice, ungentlemanly conduct, or any form of cheating is disqualification. (revised 10/98)



Author shoots his tuned .20 caliber Beeman HW97 during the 2002 Washington State Field Target Championship match. The Author became the Washington State Field Target piston-class champion, with a score of 46 out of 60 possible. — Photo by Lloyd Marquardt.



Paul Svoboda shooting his .20 caliber RWS model 48 during a local match. Clamped to Paul's air rifle is a Bushnell Trophy 4-12X-40mm AO scope, which is designed for use on spring-piston airguns. Paul's 19-20 foot-pound rifle also performs admirably for hunting chores.



Ron Carlson, while wearing his shooting jacket, steadies his custom stocked Air Arms Custom 100 during the 2000 World Championship match.



Ron Carlson, match director, center, gives last minute instructions before the 2000 World Field Target Championship match begins.



Kyle McCormack knocks down another field target with his TX200.

10). Target Sequence:

- A). The Match Director shall designate a sequence for shooting targets, by number, left-to-right, nearest-to-farthest etc.
- B). A shot on a target out of sequence shall be recorded as a miss for the correct target in sequence. (revised 4/00)
- C). If the wrong target was knocked over, it shall be reset and then shooting shall resume on the correct target in sequence. (revised 4/00)

11). Time per Shot:

- A). The Match Director and/or Marshal may impose a time limit per lane or per target either before or during a match. (revised 4/00)
- B). The timing may start when the airgun is shouldered, when the shooter addresses the lane (i.e. sits down) or as specified by the Match Director. (revised 4/00)
- C). Shots not executed within the time limit will be scored as misses. (revised 10/98)

12). Tied Scores:

- A). In the event of two (2) or more shooters tying for an award, a shoot-off, or other tie-breaking system will take place.

13). Match Director:

- A). In any matters arising and not covered by these rules, the Match Director's decision will be final. As adopted by AAFTA on 6/15/90

SAFETY RULES

- 1). All Airguns shall be kept unloaded until on the firing line, with the muzzle pointed downrange and ready to fire.
- 2). Airgun muzzles will at all times be pointed away from all persons.
- 3). When on the firing line, safe Airgun procedures will be observed including:
 - A). No Airgun will be cocked or loaded until a shot is ready to be fired downrange.
 - B). When an Airgun is cocked or loaded on the firing line, the SAFETY will not be released until the muzzle is pointed at the target and the shooter is ready to FIRE.
 - C). When cocking Spring Airguns, the Shooter must hold the cocking lever or barrel while inserting a pellet, to prevent the accidental discharge of the gun and preventing injury to himself or other shooters.
 - D). Safe spacing of shooters on the firing line is both judicious and courteous.

- E). Each shooter is responsible for his or her direction of fire, and safety toward other shooters.
 - F). When the Range Safety Officer or Marshal declares the line "COLD" all shooters will break the breech, open the loading port or bolt, or unlatch the cocking lever to signify a safe "COLD" line.
 - G). The Range Safety Officer should be notified when a shooter wishes to put-up a new practice target. The Range Safety Officer will, at his discretion, call for a "COLD" line. At that time targets may be put up on his command. On the field target course the appointed Marshals will act as deputies of the Range Safety Officer (Chief Marshal).
 - H). The Range Safety Officer or Marshal will have the final decision on matters of "Safety on the Range".
 - I). Only lead pellets may be used on the range.
- 4). Safety must be encouraged and enforced. It is therefore, important that all shooters strive to practice safe Airgun handling. It is also important, that shooters remind anyone of unsafe airgun handling and, if necessary, report unsafe practices to the Range Safety Officer or Marshal.
 - 5). NO children shall be allowed on the firing line. Junior Shooters MUST be cleared by the Range Safety Officer by being instructed on RANGE SAFETY.
 - 6). No alcohol will be allowed on the sight-in range or field target course.

THESE SAFETY RULES WILL BE STRICTLY ENFORCED. ANYONE ABUSING THESE RULES MAY BE EXPELLED FROM THE SHOOTING RANGE AND MATCH PARTICIPATION. As adopted by AAFTA on 10/30/92.

CLASSIFICATION RULES

Open Class: Any airgun, any sight.

Standard Pistol Gun Class: Any standard factory piston gun, including the factory stock, retailing for less than \$600.00 (U.S.). Maximum scope magnification is limited to 20X. Variable

scopes may not be set higher than 20X. Internal modifications to the air rifle may be made, as well as the addition of trigger shoes, muzzle weights, and slings. (revised 1/98)

Unlimited Piston Gun Class: Any piston gun and any sight. (revised 10/94)

Additional Classes: The Match Director may provide additional classes, if there are enough shooters to justify them. Note: Any or all of the above classes may be divided into sub-classes, such as A & B or A, B, & C. Usually this is accomplished by qualifying shooters by their scores from the first day, or first round of the match. The purpose of this is to attempt to keep the number of shooters in each class fairly equal, so that the percentage of prizes awarded in each class is fairly equal. It is also customary to include a team prize at major matches and the U.S. Championship match. (revised 4/00)

FIELD TARGET ETIQUETTE

A definition of Field Target is that it is a free-style shooting sport that is a viable alternative to the other existing disciplines such as Ten Meter, Silhouette and Benchrest. However, the foundation the sport of Field Target is based on is gentlemanly conduct and good sportsmanship without which our shooting sport would become at the very best - unpleasant. It behooves us all to not be distractive while others are shooting. Avoid walking behind and around a



The ever-steady Tom Price with his Maccari tuned TX200, takes aim on a field target during the 2000 World Championship match.



Bob Winer, owner of PASA, prepares to shoot his highly customized Steyr-LG100 field target rifle. Clamped to Bob's rifle (with of course BKL rings and mount) is a Bushnell Elite 4200 8-32X-40mm scope.

shooter trying to concentrate on range finding and shooting. Save idle chatter to moments when it does not disturb others. Admittedly, all this is pretty obvious stuff but I know that we have all been guilty of lapsing occasionally into a "no-think" state of being distractive. If a shooter deliberately persists in trying to rattle a fellow competitor a terrible potential burden is placed on the Match Director. Shoot Rule No. 9 states: "The penalty for deliberate infraction of the Shoot Rules, unsafe practice, ungentlemanly conduct or any form of cheating is disqualification." A protest invoking this rule would certainly be a loud sour note for any match. The protocol of Field Target requires us to be gentlemen and supportive of each other. If a shooter makes a good shot, say so. It's music to our ears even if it's a "gimme." Author: Rodney Boyce

TARGETS

- 1). **Target Types:** There are both commercial and "Home Made" targets that can be used in matches. Any target that is reliable and capable of withstanding 20 foot pound pellet strikes can be used. Targets should be tested with both high power and low power airguns. The quickest way to ruin a match is to have a target that does not work properly! The target should fall when hit in the hit zone and not fall when not hit in the hit zone!
- 2). **Hit zones:** Hit zones should be round in shape! Hit zones sizes can range from 3/8" to 1-3/4". Smaller hit zones are generally used in lesser numbers at shorter distances. (revised 4/00)

- 3). **Hit zone size and distance:** Care should be taken when placing targets at close distances since pellets can ricochet or bounce back! When setting a course, shooter proficiency should be taken into consideration. The following target distances are the recommended maximum distances for expert level shooters. (revised 4/00)

The following target placement distances are for expert shooters:

Hit Zone Size Maximum Distance

3/8" 20 Yds.

1/2" 30 Yds.

3/4" 40 Yds.

1" 50 Yds.

1"+ 55 Yds.

These distances should be reduced based on the shooters' abilities and as shooters get better they may need to be increased.

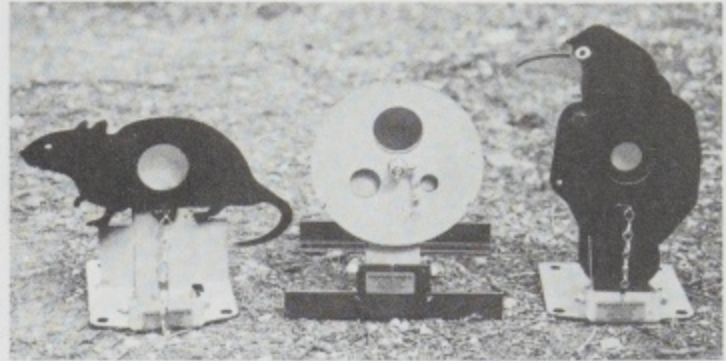
- 4). **Average target distance:** For a Regional or National match the average distance of all the targets should be 30-32 yards. Remember, you can put reduced hit zone targets at shorter distances to keep the average and still have a challenging course. It is not necessary to stretch all the 1-1/2" targets to the maximum range.
- 5). **Target strings and rubber bands:** It has been found that a good quality braided Dacron line (50-80Lb. test) will not stretch and will last longer under ultraviolet rays than Nylon or Polypropylene. This line is used for offshore fishing and is extremely durable but, it is rather expensive. It is recommended that Nylon not be used since it stretches and makes the target hard to reset. A simple fishing swivel 10-12 inches in front of the target keeps the line from becoming twisted and makes them easier to wind up after the match. A short steel braided fishing leader used through the target hole will keep the line from fraying on the metal target. Rubber bands or short bungee cords attached to the target and to the line with a little slack will curtail string snags, which prevent target knock-downs. Note: If the braided Dacron line is too expensive, use only enough for the target placement distance (i.e. 25 Yds, 40 Yds, or 55 Yds).

6). Target Installation: Targets should be securely anchored to the ground. It is important that all targets be secured to the ground and leveled (a small torpedo level will do) with the target face square to the firing line. Targets should be placed directly on the ground; any ground cover (leaves, sticks, pine needles, etc.) should be removed. Targets that are not secured will be loosened and pulled up with hard resets, thereby, making them unreliable. Tree targets need to be securely fastened to the tree so that the target will not shift out of alignment during a match. A base bracket with bolt or screw can be used to ease the removal of the tree bracket. In order to be reliable, tree targets must have rubber band or a small bungee cord attached to the reset string to prevent the string from becoming too heavy to allow the target fall when hit. Prior to installing any target on the course, it is important that all targets be lubricated and checked for proper operation. (revised 4/00)

7). Target Painting: Since Field Target shooting is a fun sport as well as a challenging sport, detailed painting of the targets make them more enjoyable for all competitors. Flat black targets don't excite anyone! A little art work goes a long way in creating realism! Hit paddles should be given a base coat of white paint then day glow orange should be applied over that. Of course, all hit paddles should be repainted between matches.

8). Target Placement: Placement relies on the imagination of the course designers with the following guidelines:

- A). All participants should share equal visibility of the entire hit zone.
- B). The terrain should dictate the shooting position.
- C). All competitors should have the same opportunity to shoot in the same shooting position.
- D). When placing a target in a lane, a spotter should be in a shooting position to give detailed instructions to the person setting the target. This way the spotter can make sure short and tall as well as, left and right



The above three British field targets were ordered from Precision Airgun Shooting Accessories (PASA). From left to right: A black rat, a moon target, which features an adjustable hit zone, and a crow, also with an adjustable hit zone.



These four creatures came from Ron Juneau's "Cajun" field target assortment.



Ron Juneau's selection of "Cajun" Field Targets. — Photo courtesy of Ron Juneau.



Above, top rated spring-gun field target competitor Albert Otter shooting a highly customized TX200 SR. Albert's scope is a customized and power-booster Leupold 25-50X. Albert's attachment towards exquisite gadgetry helped to earn him the nickname of Inspector Gadget.

handed shooters have the same advantage. Binoculars or a scope will allow the spotter to see if any obstructions exist. Lane markers should be adjusted to afford the shooter the ability to get a clear shot on all targets in the lane.

- E). All targets should be set from a predetermined plan.
- F). When setting targets the shooting sequence should be determined (i.e. shoot the nearest target then the longest target).
- G). When two targets are in one lane, care should be taken to make sure that the string from the longest target does not interfere with the other target.
- H). If the course has a tendency to have standing water or rain, make sure targets are not under water if it rains on match day.
- I). Make sure that the Marshals can get to the targets during the match.
- J). Make sure that targets in one lane cannot be confused with targets in another lane.

PRACTICE AREA (Range)

A safe practice area should be provided for the competitors the day before the match and just prior to each match. This practice area should have the following:

- 1). At least 55 yards of clear safe shooting area. (revised 4/00)

- 2). A suitable dry area to sit and shoot from.
- 3). Some form of target holders for the competitors to use.
- 4). A sturdy bench rest with sand bags.
- 5). Yardage markers each 5 yards from 10 yards to 55 yards. (revised 4/00)
- 6). Gun Racks.
- 7). A designated area for SCUBA tanks.
- 8). A designated and marked "Firing Line".
- 9). A range safety officer on the firing line at all times when shooting is taking place. The range safety officer should have complete control at all times.
- 10). Rest rooms should be available.

SAFETY

Children should not be near the firing line and should be supervised by a parent at all times! No pets should be allowed in the practice area! Spinners, practice field targets, and chronographs add to a good practice area!

During practice or during a match all AAFTA Safety Rules should be in force.

MATCH TERMINOLOGY

"Hot Line": Safe to commence firing.

"Cold Line": Cease fire, unload all guns.

Shooters Meeting: A time when the Match Director will address all competitors and discuss rules, procedures, times, number shots, and other pertinent information prior to a match.

Shooting Pad: A location from which a shot must be taken at a target in a lane.

Lane Markers: Two poles, stakes, etc. used to identify body placement on a shooters pad.

Split: When a pellet hits the edge of a hit zone on the target and "splits" into pieces, with one of the pieces striking the hit zone.

Paddle: The round disc to be hit on the target that unlatches the trigger and allows the target face to fall.

Marshal: A volunteer that administers the rules with regard to targets on the course. He also enforces the safety rules.

Range Safety Officer: Calls the line on the practice range.

Blow Off A Shot: When a competitor wants to shoot a pellet into the ground because of a bad pellet or mechanical problem.

Squad or Squadding: A group of up to three shooters.

Tie Breaker Lane: A lane designated before a match to break a tie score.

Time Limit: A time imposed on a shooter to prepare to and shoot a target.

Lane: A designated area in which a target is placed when shooting a match.

Air Bottle: SCUBA tank or equivalent.

Shooting Time: The time shooting will commence at a match.

Reset: When a string is pulled from the shooters pad to make the target ready for the next shot.

TARGET MALFUNCTION PROCEDURE

- 1). If a reset string breaks call a Marshal to repair it.
- 2). A shooter may lodge a protest if he feels a target failed to fall with a good hit. The procedure is as follows:
 - A). All shooters in his squad must complete their shots at the target in question.
 - B). If the target falls once, the protest is disallowed.
 - C). If the target fails to fall and all the squad members agree on a possible malfunction, call a Marshal who will:

Check the target for proper function, levelness and the face is square to the firing line.

- b). Repair the target.
- c). Replace the target with an identical hit zone size target.
- d). Note the protest if the target appears to be functioning properly.
- e). Remove the target from the match if it is broken or five protests have been noted by five separate squads. All competitors' scores would then be re-tabulated as hits for that target. If **a**, the decision of the Marshal is final. If **b** or **c**, shooters in the squad will reshoot, for score, the target in question. If a target is removed due to five (5) protests (the target periodically malfunctions), the target should be removed from the match and not replaced. (revised 4/00)

a).



Above a squad of four field target shooters enjoy a day in the woods shooting airguns. In fact, some field target locations are so woodsy that the shooter must be aware of the local wildlife. In some locales, critters such as snakes, lizards and spiders are common, and in the extreme south you may spot the occasional alligator taking a Sunday stroll through the woods.

CHAPTER SIX

Introduction to BR 4000



BR 4000 is a new precision shooting game; one that takes advantage of the world class match air rifle's intrinsic superior accuracy. BR 4000 was conceptualized after BR-50/BRV by Larry Brown and Mark Pfafflin. Larry Brown originally brought out BR-50 back in 1985 and is still the driving force behind BR 4000 competition.

When BR-50 was born in 1988 it included centerfire which was shot at 100 yards, .22 Rimfire which was shot at 50 yards, and airgun which was (then) shot at 25 yards. By 1997, for various reasons, only airgun competition remained, which became known as BRV. During mid 2002, BRV was overhauled into BR 4000, which incorporated a new target and revised rules. Centerfire has returned, which takes place at 300 feet, rimfire shooters now compete against

each other at 120 feet, and airgunners shoot at either 75 or 66 feet, depending on which type of airgun you shoot. The good news about BR 4000 is that airgun shooters only compete against other airgun shooters.

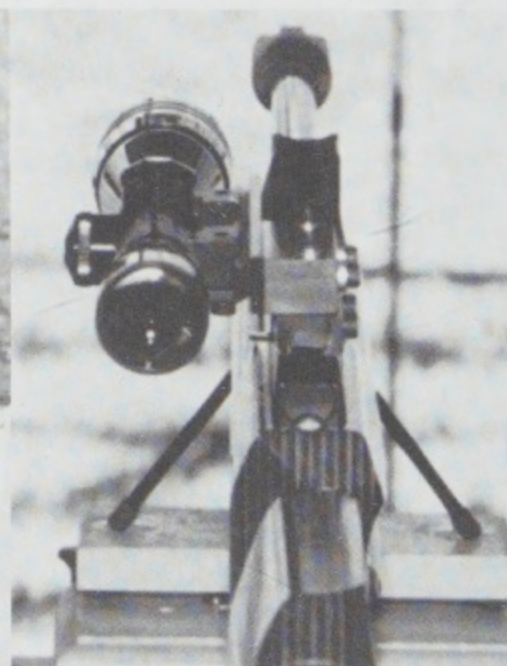
BR 4000 Airgun categories: AgO means Olympic legal, while AgX means experimental, and AgP means the gun is powered by a piston. AgO and AgP guns put out about the same velocity, which is in the vicinity of 560-650 fps and the distance to the target is 66 feet (22 yards). AgX guns usually put out more velocity, and the distance to the target is 75 feet (25 yards). I have seen many modified PCP field target guns being used in the AgX division. Two of the most popular PCP air rifles used in competition are the Anschütz 2002 and the Feinwerkbau (FWB) P70.

The new target consists of twenty "bullseyes", which must be shot inside of 15 minutes. A perfect score would fetch a score of 4000, however, Larry tells me that most scores have been hovering around 2000 to 2600. The trick is to completely take out the middle dot, which is worth 200 points and measures roughly two millimeters in diameter. The area around the middle dot is worth 100 points, with the next ring worth 75 points. This negative scoring method continues through 50, 25, 10, and finally zero points. If your pellet cuts into a ring, you get the next lower score. Whenever you are unsure whether a pellet hole is "in" or not, it will be scored to the shooter's disadvantage.

As this is written BR 4000 is in the transition stage (from BRV) and the local shooting club that



Shooters checking targets on the range.



John Mickel's Steyr match air rifle and customized offset scope setup.

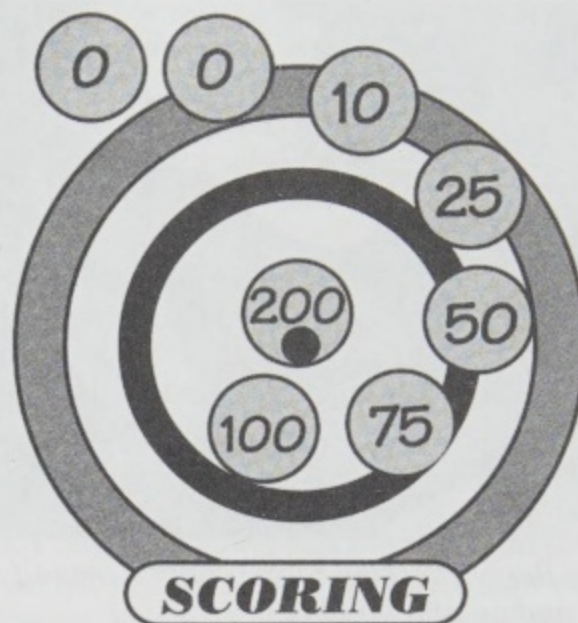
I belong to has not yet started any official matches. For whatever strange reasons, I seem to do my best shooting during practice sessions and never during an actual match. Hopefully, this situation will reverse itself in the near future. The last few years I have dabbled with BRV competition, but have been plagued by last second switchbacks of wind. Wadcutter pellets are notoriously sensitive to wind, as even seemingly undetectable little puffs of wind effect shot placement.

In my very first BRV match I shot my Tau 200 CO₂ match rifle, because it was the only match rifle I owned at the time. This match was conducted during late October, and it was a much colder than normal day, with the high temperature just able to climb to 40°f. My gun became much too cold (at times it felt frozen) and my pellet impact kept wandering and changing without rhyme or reason. My score became more dismal with each new target commensurate with how frozen my gun was becoming.

By the time the next BRV season rolled around, I had acquired a used FWB 300S spring-piston match rifle, as I was not willing to cope with the effects of a cold CO₂ gun again. I soon discovered that my first mistake was in trying to use a large "centerfire" type windflag, which was not sensitive enough to the very light breezes that were affecting my score. I ended up trying to read my fellow competitors' windflags. By the time the next BRV match came around, I had a brand new and very sensitive windflag made by Dearl Lane. However, it still wasn't my lucky day, as I had just worked an extended swing-graveyard shift and was desperately lacking sleep, but the worst part was yet to come. Soon after the match started I came down with a migraine headache and had to cope with not only the throbbing pain, but also with strange almost psychedelic like targets. Needless to say, my score for the day was abysmal.

I am one of the very few shooters who still shoot a spring-piston airgun in competition. I have been alternating between two discontinued recoilless spring-piston airguns, an RWS 75 T01 and a FWB 300S, both of which have a Simmons Pro Air 6-18X scope attached. As far as airgun fodder, I have used both H&N Finale Match and RWS R10 pellets, and have yet to determine for certain which brand works best in my rifles.

The skills that were required for top BRV shooting remain the same for top BR 4000 shooting. The best shooters are particularly adept at



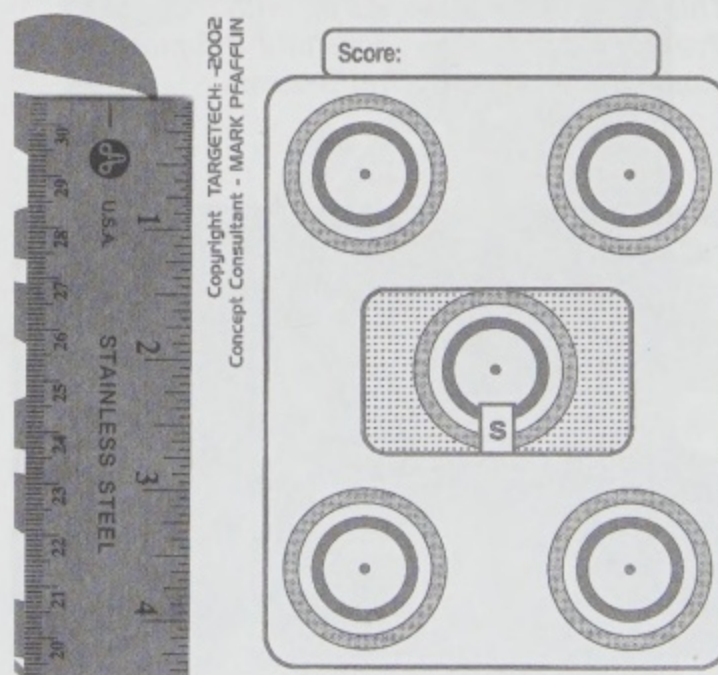
TARGET DISTANCES

CENTERFIRE:.....300-feet

RIMFIRE: RfO/RfX..120-feet

AIRGUN: AgO/AgP...66-feet,
AgX.....75-feet

BR 4000 scoring — Courtesy of Larry Brown.



A look at the new BR 4000 target. — Target sample courtesy of Larry Brown.



Dottie Berry checking targets with a magnifying glass and an official plug.



Author shooting his FWB 300S during a match. This Match rifle is topped off with a Simmons Pro-Air 6-18X-40mm scope and B-Square mounts. — Photo by Jim Benson.



Pictured above is top rated BRV shooter Tom Guerin with his Anschutz 2002CA Match air rifle and Nightforce scope.

“reading” their wind flags and seem to rarely get caught in the middle of switchback winds.

I asked top shooters Tom Guerin, and Jim Benson the following, and their answers follow.

What equipment do you use in BRV (which is now BR 4000)? (Rifle, scope, brand and type of pellet, any pellet sorting or preparation, type of windflag, etc.)

What advice (tips, or techniques) would you give to a newcomer?

“First of all, who am I? My name is Tom Guerin, and I am 73 years old. I started shooting indoor 4 position when I was 12. (I was the only kid in my Boy Scout Troop with a merit badge for marksmanship.) In 1958, I had a job in England where most smallbore shooting was outdoor prone, and I discovered I liked the challenge of the wind more than the rigors of position shooting. My accomplishments over the years included winning many State and Regional Championships and setting numerous National Records, all of which have since been broken. I hold the NRA Smallbore Distinguished Badge, member of the U.S. Dewar Team at Camp Perry, and member of the NRA 3200 Club. Advancing age and failing eyesight forced me to switch to benchrest shooting in 1995, and BRV gave me the opportunity to employ the wind doping experience that I learned from smallbore. This experience helped me win the G-Line World Championship in 2000 and 2001.

My BRV rifle is an Anschutz 2002CA. It has a 3 inch wide stabilizer plate attached to the forend rail in order to fit a #3 sandbag on the front rest. Otherwise, it is unmodified. I prefer the Anschutz to the Feinwerkbau P70 for two reasons, ease of operation and a slower rifling twist.

My scope is an older model Nightforce 12-42x 56 mm objective, which has been modified for parallax correction down to 20 yards. The reticle is a 1/8 min dot. I use the highest power setting due to the aforementioned eyesight problems.

Currently, I am using Nygord World Champion pellets with 4.50 mm head diameter. This lot was chosen after testing several different lots and head sizes indoors at 20 meters. I think that sorting, sizing, and lubing pellets is a waste of time if one can find a lot which will average 1/4 inch, extreme spread, for five 10 shot groups.

I have two different kinds of windflags, one made by Dearl Lane, and the other by H.L. Wickham. The Lane flags are lighter and more sensitive,

while the Wick flags are very visible. I switch back and forth as the mood suits me, and sometimes use them in combination. I also replaced the tails with mylar video tape. These are not as bright as surveyor's tape, but they are very sensitive in light breezes. I use 2 flags and set them at about 5 yards and 20 yards. I try to shoot when both flags are showing the same condition, but take most of my wind dope from the close flag.

BR 4000 rules permit shooting from a bipod or a front rest. I believe the bipod requires considerably more skill with regard to grip pressure, trigger control and follow through. The less one has to think about the mechanics of shooting, the more he can concentrate on the wind. My bench technique is free recoil, and I try to have as little contact with the bench or rifle as possible.

To the newcomer, I think that AgO is the easiest class to learn the fundamentals, but it is also the most competitive. This means a substantial investment in a high quality 10 meter rifle and a reliable scope. Younger shooters, with good eyesight, can get by with a lower power. Scopes with higher magnification are more sensitive to parallax adjustment, and parallax can be more deadly than wind. Each rifle is different, so pellet selection is important. Testing should be done indoors,

if possible. The most important advice, however, is practice in the wind. Any fool can pull a trigger and get a good score when the wind isn't blowing. A Champion is the person who can shoot consistently when the wind is not user-friendly."

Thanks again for this opportunity,
Tom Guerin

Top Spring-piston gun shooter Jim Benson gave the following advice and provided the equipment list that he used for during BRV competition.

"My advice to newcomers would be to first go to a match or two before you buy a gun or any equipment. Watch what is going on, and see what is being used. Then, above all, ask questions! Everybody will be more than glad to help you get started."



Jim Benson proudly displaying his FWB 300S.



Dottie Berry displays her FWB P-70 pre-charged Match air rifle.

Rifle: FWB 300S with stainless steel forend wedge.

Scope: Burris 8X32 RA with Beeman extension mounts and scope level.

Pellets: Finale Match no preparation (4.48 head).

Wicks wind flags with 6 inch 2 blade plastic prop. Hart rest with bench-rest top. Leather rear sand bag filled with kitty litter. Pellet seater. Cooking timer to let me know how little time that I have left after waiting for that "right condition" to come back.

While Jim's shooting partner Dottie Berry used the following:

Rifle: FWB P-70 with spare air tanks.

Scope: Burris 8X32 RA, with Beeman factory mounts and scope level.

Pellets: Finale Match, no preparation (4.51 head).

Wicks wind flags. Hart rest with sandbag top and a leather rear bag filled with shot.

Addendum:

Larry Brown, the founder of BR-50 (the first organized rimfire benchrest competition), and then BRV (the first airgun benchrest competition), died suddenly in early August of 2002...a short time before this book was to go to press. He had only recently plunged into a remake of the rules and targets for BR 4000, his newest form of competition, and the one that he felt would be his final answer to the search for a level playing field for airgun, rimfire and centerfire benchrest competition. The shooting sports world lost an independent, free-wheeling innovator who always gave much more than he took in life. Good bye, Larry Brown, from all of us.

CHAPTER 7

Airgun Tests/ Current Production Guns

Plus

John Whiscombe on Selecting a Whiscombe Air Rifle



Airgun Testing Procedures

I tried to come up with the most fair and meaningful way to test a variety of airguns. It would be an understatement to say that airgun pellets are not very good at defying the wind. Even a lightweight .22 long rifle rimfire round exhibits less wind deflection than the most aerodynamically efficient pellet. Pellet flight time is very long when compared to most firearms, which gives the wind more time to deflect a pellet and push it off course.

My first thought, when confronted with my large assemblage of airguns, was to accuracy test only during very calm days and hope for the best. However, my plan turned out to be a compromise at best, as even undetectable puffs of wind noticeably altered the flight path of my pellets. Despite my best efforts, more often than not ill-timed gusts of downrange wind enlarged many potentially great groups, and horizontal groups indicating crosswinds appeared common. It appeared that even with wind flags and my utmost concentration, I would not be able to shoot each gun under exactly the same conditions.

I soon realized that outdoor testing brought with it more variables than I could compensate for, and the wind was actually masking a portion of my airguns' intrinsic accuracy. It became apparent that outdoor accuracy testing of my group of airguns was not consistent enough to provide meaningful or precise airgun comparisons. My goal was to discover what common accuracy my airguns were capable of. In order to realize my goal, it appeared that indoor testing would be the only reliable way to discover my airguns "hidden" accuracy.

Luckily, I arranged to conduct and complete my accuracy tests in an indoor tunnel of sorts. You see, I found a friend who permitted me to shoot my airguns unobtrusively down a forty-yard plus secluded indoor corridor. The building where I tested my airguns was unoccupied and had no heat, which meant there was very little or no convection airflow to deal with. Nevertheless, I used a Dwyer Vaneometer to monitor possible convection currents. The Vaneometer is an ultra sensitive instrument capable of reading air currents in feet per minute. With no wind, I was able to maintain a consistent test-platform that actually measured an airgun's ability to group pellets and not my ability to dope the wind. After testing many airguns indoors and comparing my indoor data with my outdoor data, I discovered it was

common to shoot outdoor groups that were double or triple my average indoor group size.

No attempt was made to determine my airguns' "ultimate" or greatest theoretical accuracy. Attempts of this nature might well include such concepts as: pellet sizing, cleaning, weighing and sorting pellets into groups, tests involving combinations and mixtures of various pellet lubricants, as well as experiments with barrel harmonic tuning devices.

Even though I tested my airguns indoors, I don't consider the results perfect or "carved in stone". No doubt some shooter error crept into the process, and the small sampling of the models involved leave a lot of room for errors. If I were to test perhaps 100 airguns of each make and model I would be in a much better position to discover true accuracy trends, and my tests might possibly be considered a scientific analysis.

For accuracy, I shot five-shot groups that were all measured center to center, using a caliper to the nearest 1/100th of an inch, which is an accepted standard method. To lessen the chance of shooter error, a benchrest setup is commonly used to test firearms, but airguns differ from firearms. After a bit of experimentation, I discovered I could shoot more consistently using my Ultimate Tripod built by McFadden Machine Co., Inc. (Sold by Robert W. Hart & Son, Inc. – see appendix for more information.) Each airgun went through a series of pre-tests, which was done to determine where to place the gun on the tripod and how much shoulder contact was needed for the best consistency. A small series of shots were also taken in the sitting position to establish a base accuracy. In every case except one, the best accuracy was obtained using the Ultimate Tripod. My .25 caliber Beeman Kodiak was the lone gun that actually shot more consistently in the sitting position than on the Ultimate Tripod.

I limited myself to a scope magnification of 24X, even if my test rifle had a scope attached that was capable of additional magnification. To measure cocking effort on my break-barrel guns I used a Health-O-Meter bathroom scale. I did not check the cocking effort on my other cocking type of guns because I was not comfortable with my method and did not wish risking a miscue and having an accident.

Velocity was measured using an Oehler 35P chronograph and the optional indoor lighting setup, while I kept the muzzle of each gun about

6 inches from the start screen. Unless otherwise stated, I used 25 shot strings to determine an average velocity and extreme velocity spreads. My "default" ammo was Crosman's Premier domed pellet. Pellets came straight out of the box, except as noted with regards to lubrication.

Airgun muzzle energy in foot-pounds was figured using the following formula: Foot-pounds = the square of the velocity in fps multiplied by the weight of the pellet in grains and divided by the factor 450,240 (Ft.-lbs. = fps x fps x grains ÷ 450,240).

I chose a handful of test airguns to determine pellet penetration. Limited tests with Ivory soap bars were used to discover common penetration and were shot as indicated from a distance of 10 or 20 yards. The soap bar test was not meant to be representative of any live animal tissue. Soap was selected because it is a relatively stable medium that works well in tests designed to illustrate pellet penetration and potential wound channels. Ambient temperatures of the soap bars ranged from about 70°F to 83°F. I discovered that my soap bars were sensitive to temperature changes and gave different results when the mercury dipped. I also learned that different lots of soap reacted differently in regards to penetration, and I stopped using soap as a test medium when my largest lot of soap was exhausted. The very newest lots of Ivory soap seem to be much softer than the older lots. By the way, my lot of Ivory soap bars measured an average thickness of .950".

.22 Rimfire Soap Penetration Comparison Test

For a comparison between airguns and rimfire firearms, I used my Remington model 541-T .22 rimfire rifle. I loaded my bolt action with .22 short cartridges and when shot at Ivory soap bars at 10 yards, the 29 grain projectiles showed no expansion. My penetration results follow:

.22 Short - Target CCI 29 grain solid

(approx. 830 fps. 44 ft./lb energy) = 6.25 bars

.22 Short - CB CCI 29 grain solid

(approx. 727 fps. 33 ft./lb energy) = 4.75 bars

Next I tested a magazine full of .22 LR. CCI Mini-Mag 36 grain HP cartridges (approx. 1280 fps. and 135 ft./lb. of energy) at 20 yards into Ivory soap bars, which I discovered penetrated 7.25" bars and expanded to .342".

Selected airguns and pellets were tested for soap penetration and are included in the following text.

Airgun Tests / Current Production Guns

Models from AIR ARMS

TX200 .177 Mk III (FAC version)

Manufacturer: Air Arms, East Sussex, England

Factory specifications

Type of power plant: Spring-piston

Cocking method: Under-lever

Weight: 9.26 pounds

Overall length: 41.33"

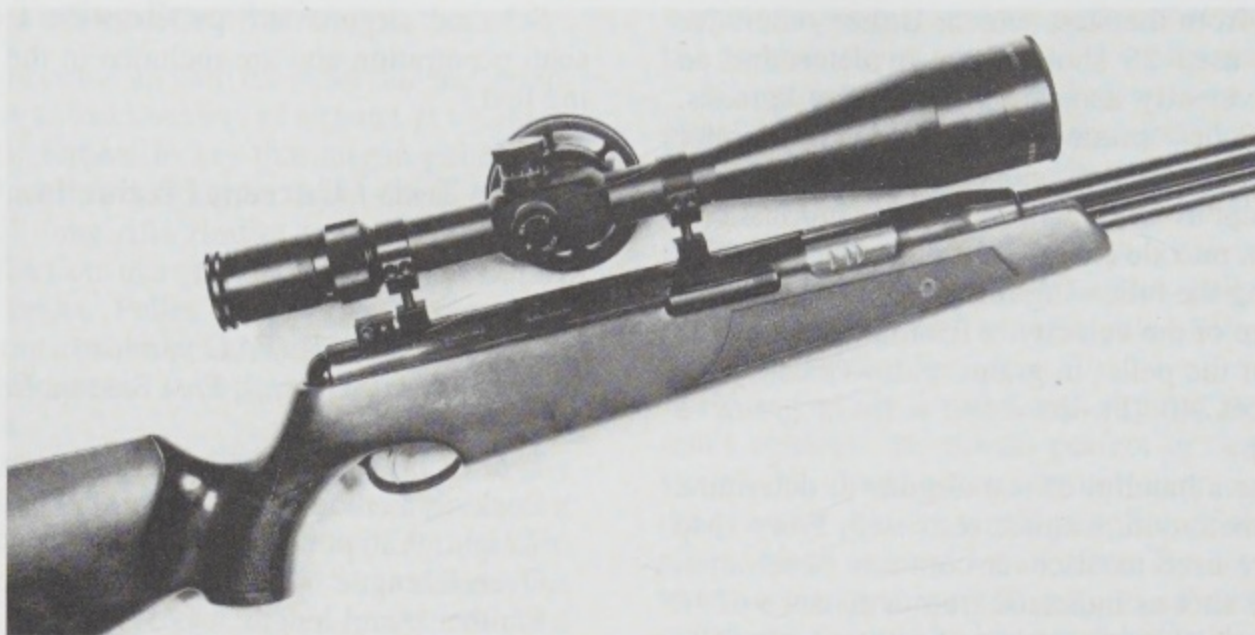
Walther barrel length: 14.05"

FAC power: (.177) 17.5 ft/lbs.

The current production TX200 is still one of the favorites among field target shooters worldwide. The new stock has impressed checkering, whereas some of older models featured cut checkering. The anti bear-trap ratchet mechanism has been redesigned and is now quieter, a feature that hunters will surely appreciate. Many shooters report that velocity has increased slightly (as compared to the Mk I and Mk II versions) and should be hovering around 920-940 fps with 7.9 grain Premiers. Since the distributor, Top Gun Air Guns tuned my gun, and my particular tune evidently reduced velocity, I can't say for certain how much of a velocity increase you should expect from a factory non-tuned model. Muzzle velocity on my tuned model is averaging 844 fps. with 7.9 grain Crosman Premiers. However, at this velocity it is a calm shooter with no perceived vibration and only moderate recoil.

After my tune, I discovered an unanticipated advantage. I also own an older TX200 SR (SR for Semi-Recoiling) and this model was engineered to produce no greater than 12 foot-pounds of energy. As it turned out, my new TX200 was de-tuned velocity wise to match almost exactly (however unintentionally) the power level of my TX200 SR. Since both my TX200 models virtually duplicate each other, power-wise and ergonomically, I can more easily interchange between them in competition (with no change in trajectory) if the need arises.

The need for a backup rifle became a valid necessity for me this past season when I was competing in a local field target match. While shooting my older TX200 SR and doing quite



Author's .177 caliber TX200 with a BSA Platinum 10-50X scope attached with B-Square mounts.

well by most standards, because I was knocking down better than 80% of my targets, suddenly halfway through the match inexplicably I started missing some easy targets. Eventually, I realized that my scope mount had worked itself loose. However, with no time to re-tighten everything and to re-zero my scope I had no recourse but to proceed to plan "B" and quickly uncased my backup TX200 Mk III. Of course, I had to re-acquaint myself to the sensation of spring-gun recoil, but the transition went fairly smoothly, and I soon returned to my normal cadence and ended up knocking down a good percentage of those wily field targets.

Accuracy from my Mk III is more than adequate for American field target. Shooting 7.9 grain Premiers at my 40-yard indoor targets, my four 5-shot groups averaged .51". For field target shooting, I installed a BSA Platinum 10-50X-60mm scope in B-Square mounts.

TEST RESULTS/ Oehler 35P Chronograph/ about 6 inches from start screen

Air Arms TX200 Mk III (tuned by Top Gun Air Guns)

Pellet tested: .177 caliber 7.9 grain Crosman Premier

Velocity:

Hi	851	fps
Low	834	fps
ES	017	fps
SD	005	fps
Avg.	844	fps
Energy	12.49	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .51" (24X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 8

TX200 .22 Mk III (FAC version)

Manufacturer: Air Arms, East Sussex, England

Factory specifications

Type of power plant: Spring-piston

Cocking method: under-lever

Weight: 9.26 pounds

Overall length: 41.33"

Walther barrel length: 14.05"

FAC power: (.22) 17.5 ft/lbs.

I heard such good things about the TX200 .22 version that I had one shipped straight from Top Gun Air Guns to Ken Reeves for a tune. My goal was to get the gun to put out around 17 or 18 foot pounds of energy, and the rifle would be used for medium range hunting and pest elimination.

It's a good thing I had the gun sent to Ken Reeves, because straight out of the box it was not even capable of being cocked, plus it suffered from a host of other problems. Evidently, my particular specimen didn't undergo any test firing before it left the factory, as would have been the norm. This incident illustrates that gun writers don't necessarily receive special selected specimens, for I have certainly had my share of strange problems and defects with some of my airguns.

Ken Reeves reported that the piston stem was not finished, and the rear of the piston skirt was not to the correct dimension either, which kept the stem from locking into the trigger mechanism. The factory spring was quite short, and the velocity was low as a result. As it was discovered, the top hat was in upside down, so the factory evidently installed the shorter spring to compensate, rather than looking to see why a normal spring wouldn't fit. Ken replaced the spring with an aftermarket OX Accelerator spring during his extensive tune and repair procedure. But after the gun was all reassembled, — it turned out to be a sweet and smooth shooter, with no vibration or dieseling.

The .22 caliber Crosman Premier seemed to fit somewhat loosely in the bore, and I surmised this was the reason for the reduced velocity. However, the slightly larger Eley Wasp pellet seemed to fit the bore just right and also delivered better accuracy and higher velocity. For short to medium-range hunting I installed a Bausch & Lomb Elite 3000 4-12X-40mm in adjustable B Square mounts.

TEST RESULTS/Oehler 35P Chronograph/ about 6 inches from start screen

Air Arms TX200 Mk III .22 (tuned by Ken Reeves)

Pellet tested: .22 caliber 14.3 grain Crosman Premier

Velocity:

Hi	734	fps
Low	700	fps
ES	034	fps
SD	011	fps
Avg.	713	fps
Energy	16.14	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .62" (12X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 9

TEST RESULTS/Air Arms TX200 Mk III .22 (tuned by Ken Reeves)

Pellet tested: .22 caliber 14.5 grain Eley Wasp

Velocity:

Hi	761	fps
Low	746	fps
ES	015	fps

SD	006	fps
Avg.	755	fps
Energy	18.35	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .56" (12X magnification)

Soap penetration test: 10 yards

Eley Wasp = 3.9 to 4 bars of Ivory soap

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 9

AIR ARMS PRO SPORT .177 (FAC)

Manufacturer: Air Arms, East Sussex, England

Factory specifications

Type of power plant: Spring-piston

Cocking method: under lever

Weight: 9.04 pounds

Walther barrel length: 9.64"

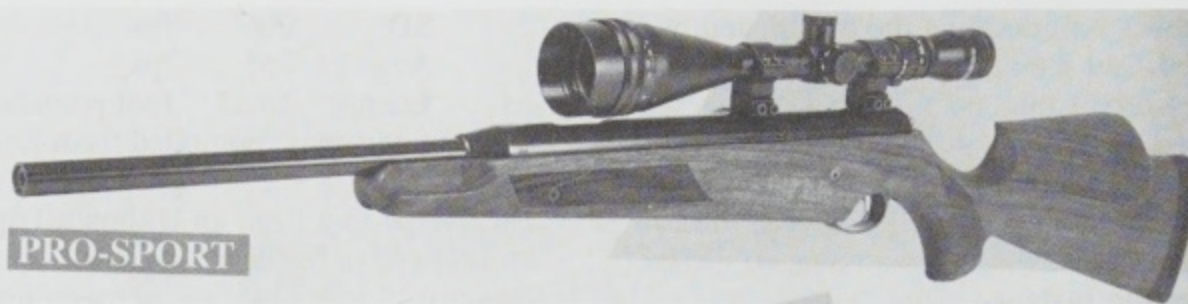
Overall length- 41.14"

FAC power: (.177) 15.5 ft/lbs.

Air Arms introduced the Pro Sport to eager American airgun shooters in 1996. The Pro Sport appears to be a reworked factory version of Trooper Walsh's ultra sophisticated Venom Mach II under-lever springer. The Venom Mach II is no longer in production, but it was essentially a custom air rifle built to painstaking standards. Evidently, it was a tough standard for the factory Pro Sport to live up to. However, remember the Pro Sport is only a mid-priced air rifle, and the base model Venom Mach II carried a price tag that started almost four times as high. In reality, can any "factory" mid-priced air rifle really compare to a much more expensive custom rifle?

I view the Pro Sport as a classy looking and accurate spring air rifle that was designed to be an upscale brother to the TX200. The svelte appearing Pro Sport has its cocking arm hidden within the stock, which alters the balance of the rifle just so ever slightly. Ken Reeves says the Pro Sport incorporates the same internal workings as the TX200. Mine had a mild vibration problem and was dieseling rather heavily, so I shipped it off to Ken Reeves for a basic tune.

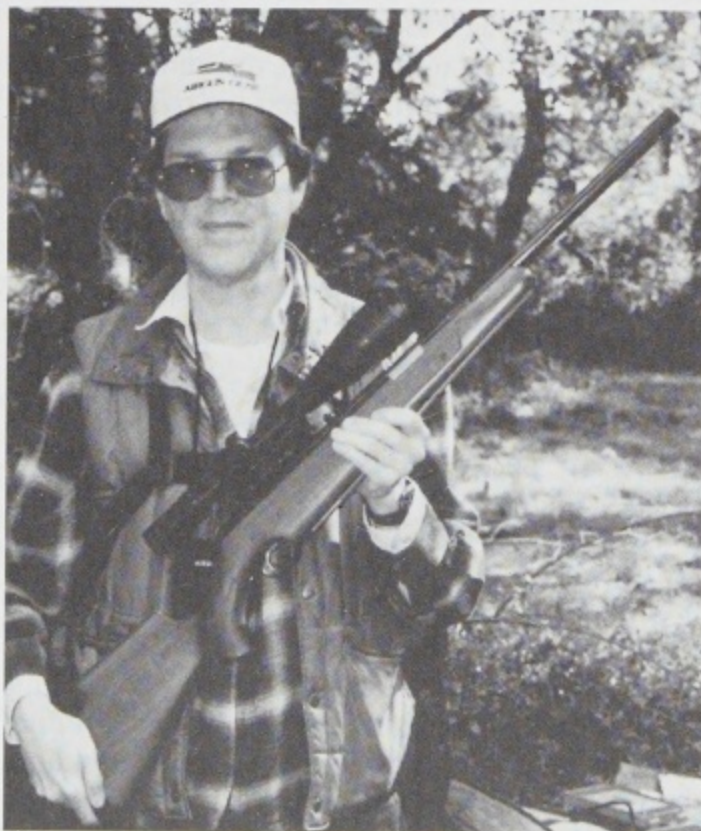
For whatever the reasons, the Pro Sport seems to be one of those guns that most people either love, or hate, with not many shooters straddling the fence halfway about it. Evidently the factory had made several internal changes during production, which may explain why there are so



The svelte appearing Air Arms Pro Sport air rifle.
— Photo courtesy of Top Gun Air Guns.

many widely differing reviews of this rifle. The reason that you might love your particular Pro Sport, but your neighbor hates his, possibly could be dependent upon which version you received from the factory.

The main reason I wasn't exactly enamored with my Pro Sport centered on the cocking arm and the lack of good ergonomics. Because of the way the cocking arm was engineered, my Pro Sport seems harder to cock than its older sibling, the TX200. While sighting in and shooting my Pro Sport in a field target match, I learned to get a much better feel for the way it cocked and learned to live with it without much ado. For testing, I mounted a Bausch & Lomb Elite 3000 5-15X-50mm scope on my Pro Sport with B-Square mounts. Accuracy testing revealed my



Author and his Pro Sport all ready for field target.

Pro Sport prefers the heavier 10.5 grain Crosman Premiers to the lighter 7.9 grain version.

TEST RESULTS/Oehler 35P Chronograph/ about 6 inches from start screen

Factory Air Arms Pro Sport .177 Caliber

Pellet tested: .177 caliber 7.9 grain Crosman Premier

Velocity:

Hi	929	fps
Low	870	fps
ES	059	fps
SD	019	fps
Avg.	901	fps
Energy	14.24	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .61" (15X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 7+

TEST RESULTS/Air Arms Pro Sport (tuned by Ken Reeves)

Pellet tested: .177 caliber 7.9 grain Crosman Premier

Velocity:

Hi	921	fps
Low	906	fps
ES	015	fps
SD	005	fps
Avg.	915	fps
Energy	14.68	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .55" (15X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 7+

As tuned: 8+



Author's Air Arms Pro Elite in .22 caliber.

TEST RESULTS/Air Arms Pro Sport (tuned by Ken Reeves)

Pellet tested: .177 caliber 10.5 grain Crosman Premier

Velocity:

Hi	786	fps
Low	766	fps
ES	020	fps
SD	006	fps
Avg.	778	fps
Energy	14.11	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .50" (15X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 7+

As tuned: 8+

AIR ARMS PRO ELITE .22 (FAC version)

Manufacturer: Air Arms, East Sussex, England

Factory specifications

Type of power plant: Spring-piston

Cocking method: Break barrel

Weight: 9.3 pounds

Overall length: 40.98"

Walther barrel length: 14"

FAC Power: (.22) 22 ft/lbs.

The Pro Elite is Air Arms' entry into the world of high power break barrel hunters. The story I hear is that the Pro Elite was initially made to fill a Middle Eastern military order to be used as a training rifle. I chose a .22 caliber version, with the belief that a heavier .22 pellet (over that of a .177 pellet) would make a more efficient hunting rig. In factory guise, mine was pushing Crosman Premiers to an average velocity of 800 fps; this equates to 20.32 foot-pounds of energy.

Somewhat heavy recoil, combined with moderate vibration, motivated me to send this rifle to Ken Reeves to be tuned. Mine was also dieseling a fair amount, which led me to believe it was over lubricated by the factory. I asked Ken if it would be possible to keep the velocity about the same, but at the same time eliminate the vibration and perhaps tone down the recoil a tad. Ken said he would try, but made no promises. As it turned out, Ken's tune worked out great. My tuned version exhibits no dieseling, and no vibration, however, the jury seems to be out about the recoil, because I perceive the recoil as about the same, but a field target shooting friend of mine seems to think it shoots with less recoil now. Once I started shooting over my indoor chronograph, I discovered it gained a tad of velocity with a lower extreme spread.

I've used my Pro Elite to effectively take several dozen Montana ground squirrels out to distances of around 50-70 yards. I installed a Bausch & Lomb Elite 3000 4-12X-40mm scope, which has worked out great.

TEST RESULTS/ Oehler 35P Chronograph/ about 6 inches from start screen

Factory Air Arms Pro Elite .22 Caliber

Pellet tested: .22 caliber 14.3 grain Crosman

Premier

Velocity:

Hi	810	fps
Low	777	fps
ES	033	fps
SD	009	fps
Avg.	800	fps
Energy	20.32	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .64" (12X magnification)
 Cocking effort: 38-39 pounds
 Trigger rating: (1= abysmal, 10 = perfect)
 Factory trigger: 7

TEST RESULTS/Air Arms Pro Elite .22

Caliber (tuned by Ken Reeves)

Pellet tested: .22 caliber 14.3 grain Crosman

Premier

Velocity:

Hi	825	fps
Low	805	fps
ES	020	fps
SD	005	fps
Avg.	815	fps
Energy	21.09	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .65" (12X magnification)

Cocking effort: 38-39 pounds

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 7

As tuned: 8

Models from Beeman Precision Airguns

Beeman R1 (HW80)

Manufacturer: Weihrauch, Hans-Hermann, Mellrichstadt, Germany

Factory specifications

Type of power plant: Spring-piston

Cocking method: Break barrel

Weight: 8.7 pounds

Overall length: 45.2"

Velocity: 765 fps (.22 caliber)

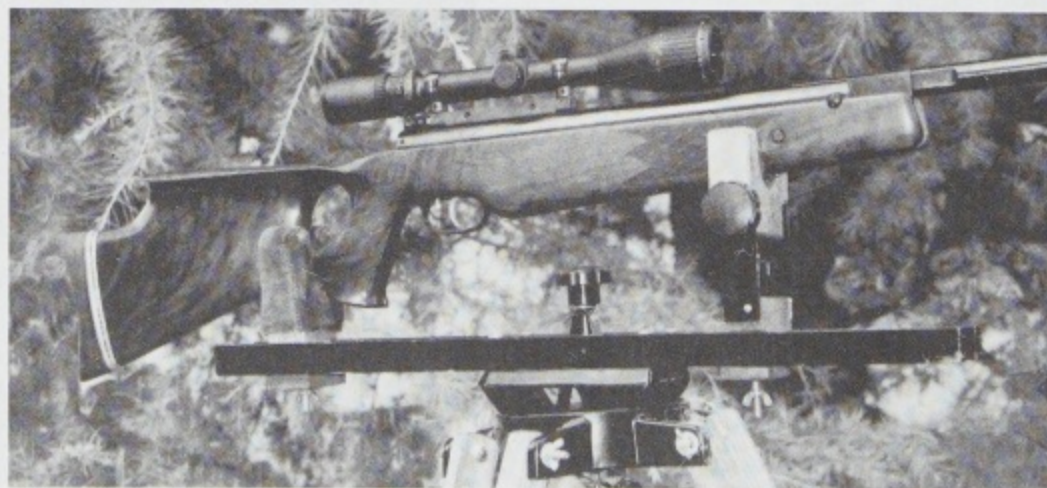
Cocking effort: 34 pounds

A perennial best seller and a flagship magnum spring-piston air rifle for Beeman. I have been shooting examples of this model off and on for almost two decades. The R1 is known to be the first airgun that was designed with the help of computer simulation. Dr. Robert Beeman, while working closely with the German firm Hermann Weihrauch, perfected the Beeman R1, and by late 1981, this air rifle was selling briskly to eager American airgunners. The Weihrauchs also had an agreement with Beeman that they could market their own European version of the R1 air rifle, known as the HW 80.

I put off buying my own R1 because a friend of mine left his .22 caliber R1 at my house for me to shoot and evaluate. However, unbeknown to me, my friend soon moved to another state and unthinkably left his R1 behind. I used this borrowed R1 to shoot a wide variety of pests and varmints. From rats to raccoons, it performed admirably and predictably. Years later, I finally caught up to my surprised friend and gave him his long "lost" (albeit well cared for) Beeman R1. Soon thereafter, I ordered my own Beeman R1.

I currently own two versions (both .22 caliber) of this rifle featuring different custom tunes. Tim McMurray of Mac-1 Airguns performed tune number one, while Ken Reeves worked his magic on my second R1.

Since the R1 is capable of putting out considerable energy in its factory guise, it was only natural that shooters would crave yet even more power. Power increasing tunes by Beeman and several others are quite popular.



Author's custom stocked gas-ram powered Beeman R1 on the Ultimate Tripod.



The ubiquitous Beeman R1 remains a top selling magnum air rifle.
— Photo courtesy of Beeman Precision Airguns.

Tim McMurray and I discussed the intricacies of various airgun tunes, after which I decided to opt for his Venom Lazaglide tune for my R1. The Lazaglide tune includes a lathe-turned piston with a synthetic "Power Pulse" piston seal. The Lazaglide piston also incorporates six synthetic bearings strategically placed to prevent vibration by reducing friction. With such an arrangement, there is no metal on metal contact and hence no piston vibration. Tim had R1's in stock, which meant his Lazaglide tune was performed before I acquired the gun.

Beeman .22 R1 with a Lazaglide Tune from Mac-1

Mac-1 must have been able to tweak more power with less cocking effort than earlier tests had indicated. Mine cocks with only 33-34 pounds of effort, and yet it delivers an average velocity of 830 fps with .22 caliber Crosman Premiers. (Factory .22 caliber R1's normally push Premiers around 740-770 fps.) This air rifle has become one of my favorite medium range hunters. Zero vibration and a quick and smooth shot cycle are hallmarks of the Lazaglide. Recoil is present for sure, but it seems "faster" than a stock non-tuned R1. I have made countless clean kills on headshot ground squirrels that were laser ranged out to over 60 yards. My record head-shot with this rifle was taken at 69 yards in distance, and my quarry was an average size rockchuck of around 10 or 11 pounds. For the record, I used a .22 Crosman Premier pellet. My chosen scope for this rifle is the Bausch & Lomb Elite 3000 series 5-15X-50mm with adjustable B-Square mounts.

TEST RESULTS/Oehler 35P Chronograph/ about 6 inches from start screen

Beeman R1 (Lazaglide tune by Mac-1)

Pellet tested: .22 caliber 14.3 grain Crosman Premier

Velocity:

Hi	834	fps
Low	823	fps
ES	011	fps
SD	003	fps
Avg.	830	fps
Energy	21.88	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .57" (at 15X magnification)

Soap penetration test: 10 yards

14.3 Premiers = 5.5 bars of Ivory soap

Cocking effort: 33-34 pounds

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 8+

Beeman .22 R1 with a High Power tune from Ken Reeves

Over the years, Ken Reeves has had numerous requests for an R1 "power" tune. Ken Reeves responded with a bag of tricks that tweaks the power upwards to 21-22 foot-pounds of muzzle energy. Ken's tricks include a special modified piston seal along with a new after-market spring. Ken also tuned and adjusted the trigger on mine to release with a light 14-ounce pull. With everything tested, tweaked and reassembled my .22 caliber R1 was launching Crosman Premiers accurately at a mean velocity of 820 fps. Recoil was present for sure, but vibration was virtually eliminated. As far as optics, I installed an excellent Bushnell 3200 series 4-12X-40mm scope. Not only is this scope designed for use on a spring-piston airgun, it also focuses down to 10 yards.

My Reeves-tuned R1 proved valuable by helping me eliminate several pests, which included a strange acting and possibly rabid raccoon and several ground squirrels.



Above, the Beeman R9 Deluxe remains a bargain among popular mid-priced air rifles.
— Photo courtesy of Beeman Precision Airguns.

TEST RESULTS/Oehler 35P Chronograph/ about 6 inches from start screen

Beeman R1 (tuned by Ken Reeves)

Pellet tested: .22 caliber 14.3 grain Crosman

Premier

Velocity:

Hi 827 fps

Low 814 fps

ES 013 fps

SD 004 fps

Avg. 820 fps

Energy 21.35 foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .59" (at 12X magnification)

Cocking effort : 35-36 pounds

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 9

Customized Beeman R1 — .177 Gas Ram version with custom Venom walnut stock and a 16 inch Marksman 58-S heavy barrel.

Manufacturer: Weihrauch, Hans-Hermann,
Mellrichstadt, Germany, with the gas-ram unit
manufactured by Theoben Engineering.

Factory specifications

Type of power plant: Gas Spring

Cocking method: Break barrel

Velocity: 1070 fps (.177 caliber)

Cocking effort: 40 pounds.

Beeman R1 Gas Ram

Pellet tested: .177 caliber 7.9 grain Crosman

Premier

Velocity:

Hi 988 fps

Low 969 fps

ES 019 fps

SD 004 fps

Avg. 977 fps

Energy 16.74 foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .53" (at 12X magnification)

Cocking effort: 45-46 pounds

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 9

Beeman R9 (HW95)

Manufacturer: Weihrauch, Hans-Hermann,
Mellrichstadt, Germany

Factory specifications

Type of power plant: Spring-piston

Cocking method: Break barrel

Weight: 7.3 pounds

Overall length: 43"

Velocity: 930 fps (.177)

Cocking effort: 40 pounds

The Beeman R9 was the replacement for the R10. Ken Reeves says the R9 is essentially an upgraded R10, as the R9 has an improved piston. The reasonably priced R9 is a great value for the dollar and a good air rifle for the shooter that is new to the sport or wishes to move up from an economy air rifle. Out of the box, the R9 has nearly the power of a Beeman R1 in a lighter package. Of course, the R1 has more aftermarket potential, but not every shooter will take advantage of the extra reserve built into the R1. The R9 has that great adjustable Rekord trigger and plenty of accuracy to keep shooters happy.

I opted for the upgraded blue-gray laminated stock that came with the 2000 limited edition Millennium R9. After mine was tuned by Ken Reeves, I installed a Bushnell Trophy 4-12X-40mm scope, then tested for accuracy and discovered it preferred Beeman FTS pellets.

**TEST RESULTS/ Oehler 35P Chronograph/
about 6 inches from start screen****Beeman R9** Millennium .20 Caliber (tuned by
Ken Reeves)Pellet tested: .20 caliber 14.3 grain Crosman
Premier

Velocity:

Hi	692	fps
Low	668	fps
ES	022	fps
SD	007	fps
Avg.	674	fps
Energy	14.42	foot pounds

Average accuracy: compiled from four 5-shot
groups.All groups shot from an Ultimate Tripod built
by McFadden Machine Co., Inc.

40 yards indoors: .68" (12X magnification)

Cocking effort: 29-30 pounds

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 8+

TEST RESULTS/**Beeman R9** Millennium .20 Caliber (tuned by
Ken Reeves)

Pellet tested: .20 caliber 12.2 grain Beeman FTS

Velocity:

Hi	804	fps
Low	795	fps
ES	009	fps
SD	002	fps
Avg.	798	fps
Energy	17.25	foot pounds

Average accuracy: compiled from four 5-shot
groups.All groups shot from an Ultimate Tripod built
by McFadden Machine Co., Inc.

40 yards indoors: .61" (12X magnification)

Cocking effort: 29-30 pounds

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 8+

BEEMAN KODIAK (Webley Patriot)Manufacturer: Webley & Scott, LTD.,
Birmingham, EnglandFactory specifications:

Type of power plant: Spring-piston

Cocking method: Break barrel

Weight: 9 pounds

Overall length: 45.6"

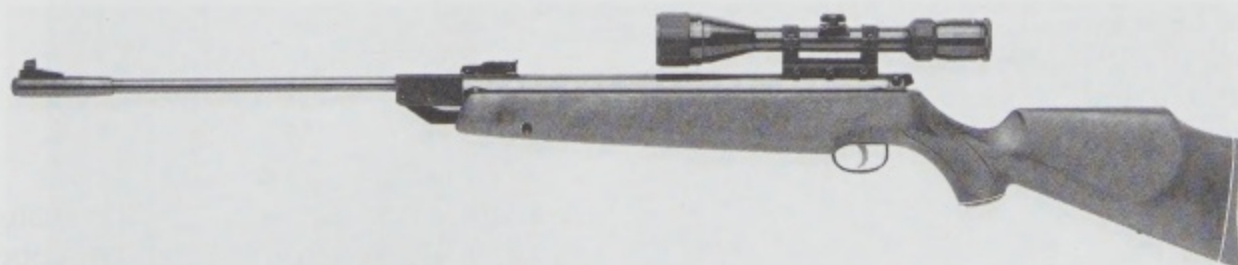
Velocity: 750 fps (.25 Cal.)

Cocking effort: 48 pounds

Beeman brought the Kodiak from across the pond in 1993 where it is known in England as the Patriot. Suffice to say, its arrival in the U.S. made a big splash! The Kodiak is regarded as the most powerful air rifle that uses a conventional main-spring. Beeman has always recommended the .25 caliber to take advantage of the larger bore size, however it is from time to time available in .22 caliber as well.

The .25 caliber Kodiak became my first really powerful air rifle. Oh, I owned several so called magnum air rifles, but the Kodiak was my first rifle that delivered over 25 foot pounds of energy. As a gun-scribe, I was able to latch onto a Kodiak straight from Beeman when it first appeared on the market. I remember when I first tried to cock my new rifle^o the barrel didn't budge no matter how much I pulled downward. Did I suddenly lose my strength? Perhaps I was exposed to a trace of Kryptonite or something? Then I gave the barrel a good quick whack, and bingo, it finally unhinged. Cocking the Kodiak the remainder of its stroke was stout, but not overwhelming. It would be an understatement to say the Kodiak has a strong barrel lockup! I found the easiest way to cock this beast is to place the butt on the ground and bend down to cock it. My Kodiak soon became my favorite short to mid-range ground squirrel air rifle.

My Kodiak was one rifle that did not respond favorably to the padded Ultimate Tripod under



The Beeman Kodiak remains "top-dog" as a powerhouse spring-piston air rifle.
— Photo courtesy of Beeman Precision Airguns.

the forearm, as my groups were about 30% larger. The group averages listed were obtained by shooting in the sitting position with a Steady Rest shooting harness.

**TEST RESULTS/ Oehler 35P Chronograph/
about 6 inches from start screen**

Beeman Kodiak (Super Tuned by Beeman)

Pellet tested: .25 caliber 21 grain Diana Domed
Magnum

Velocity:

Hi	795	fps
Low	776	fps
ES	019	fps
SD	005	fps
Avg.	786	fps
Energy	28.81	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot in the sitting position with a Steady Rest harness.

40 yards indoors: .74" (9X magnification)

Soap penetration test: 10 yards

21 gr. Diana domed = 5.25 bars of Ivory soap
(many shock cracks in bar)

Cocking effort: 46-47 pounds

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 7

TEST RESULTS/

Beeman Kodiak / .25 Caliber (Super-Tuned by Beeman)

Pellet tested: .25 caliber 26.2 grain Beeman
Crow Magnum

Velocity:

Hi	706	fps
Low	680	fps
ES	026	fps
SD	006	fps
Avg.	694	fps
Energy	28.02	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot in the sitting position with a Steady Rest harness.

40 yards indoors: .92" (9X magnification)

Soap penetration test: 10 yards

26.2 gr. Crow Mag = 4.0 bars of Ivory soap

Cocking effort: 46-47 pounds

TEST RESULTS/

Beeman Kodiak / .25 Caliber (Super-Tuned by Beeman)

Pellet tested: .25 caliber 30.9 grain Beeman
Kodiak Match

Velocity:

Hi	648	fps
Low	636	fps
ES	012	fps
SD	005	fps
Avg.	642	fps
Energy	28.28	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot in the sitting position with a Steady Rest harness.

40 yards indoors: .77" (9X magnification)

Soap penetration test: 10 yards

Kodiak Match = 5.0 bars of Ivory soap (bar
cracked in half)

Cocking effort: 46-47 pounds

**TEST RESULTS/ Oehler 35P Chronograph/
about 6 inches from start screen**

Beeman Kodiak / .22 Caliber (Super Tuned by Beeman)

Pellet tested: .22 caliber 14.3 grain Crosman
Premier

Velocity:

Hi	914	fps
Low	897	fps
ES	017	fps
SD	004	fps
Avg.	905	fps
Energy	26.01	foot pounds

Average accuracy was not tested because I was shooting a borrowed rifle with no scope.

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 7

TEST RESULTS/

Beeman Kodiak / .22 Caliber (Super tuned by Beeman)

Pellet tested: .22 caliber 18.2 grain Beeman
Crow Magnum

Velocity:

Hi	772	fps
Low	736	fps
ES	036	fps
SD	008	fps
Avg.	755	fps
Energy	23.04	foot pounds

Average accuracy was not tested because I was shooting a borrowed rifle with no scope.

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 7

Beeman (Theoben) SLR 98

Manufacturer: Theoben Engineering,
Cambridgeshire, England

Factory specifications

Type of power plant: Gas-Ram

Cocking method: Underlever seven-shot
repeater

Weight: 7.9 pounds

Overall length: 39"

Velocity: 780 fps (.22 Cal.)

Cocking effort: 27 pounds

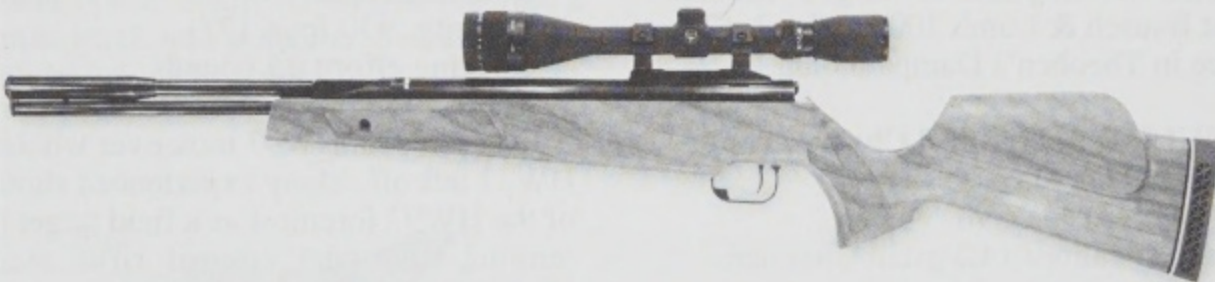
The SLR 98 is regarded as a very high quality medium power, hunting carbine. The general fit and finish is superb. The internal workings are sealed for life, which means if it ever needs servicing, only Beeman or Theoben should service it.

Airgun hunters shooting the SLR 98 fear not about keeping the rifle cocked for extended periods because it does not have a physical spring, only sealed compressed nitrogen, which cannot weaken despite being left in the cocked mode for extended periods. The Theoben gas-ram system does not suffer from spring induced vibration

either. Most airgun hunters will also appreciate the seven-shot auto loading magazine. Once the magazine is loaded and ready, all the shooter does is cock the underlever and a new pellet is automatically loaded. A positive but silent inside the trigger guard type of safety completes the picture.

Theoben uses a special piston which utilizes special shaped grooves that are cut into the crown of the piston. Theoben calls this design a Zephyr piston and it improves air flow consistency and reduces turbulence trapped in front of the piston. To prevent piston bounce, Theoben uses a device called a Floating Inertia. The Floating Inertia acts as a weight inside the piston, that is until the piston starts in motion. Then it follows the piston in action, and when the piston reaches the end of its stroke the Inertia device impacts microseconds behind the piston to prevent piston bounce.

Attesting to its accuracy the SLR 98 is also sometimes seen in the field target circuit. However, because it is available only in .22 caliber it is probably better suited for medium-range hunting and pest control, as most ardent field



Shooters who appreciate attention to detail and superb fit and finish favor the exquisite Beeman SLR 98.

— Photo courtesy of Beeman Precision Airguns.



Above, Mike Reynolds is testing the author's Beeman SLR 98.



Top, an old style Beeman HW97, bottom, the author's HW97 MKIII with a BSA Platinum 10-50X scope in BKL mounts and rings.

target shooters prefer .177 caliber rifles for a flatter trajectory.

For general shooting and hunting, I installed an excellent Bausch & Lomb 3000 series 4-12X-40mm scope in Theoben's Dampa mount.

TEST RESULTS/ Oehler 35P Chronograph/ about 6 inches from start screen

Beeman (Theoben) SLR 98

Pellet tested: .22 caliber 14.3 grain Crosman Premier

Velocity:

Hi	729	fps
Low	716	fps
ES	013	fps
SD	004	fps
Avg.	723	fps
Energy	16.6	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .56" (12X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 9

Beeman HW 97 Mk III

Manufacturer: Weihrauch, Hans-Hermann, Mellrichstadt, Germany

Factory specifications

Type of power plant: Spring-piston

Cocking method: Underlever

Weight: 9 pounds

Overall Length: 41"

Velocity: 930 fps (.177)

Cocking effort: 35 pounds

The Beeman HW97 took over where the older HW77 left off. Many experienced shooters think of the HW97 foremost as a field target rifle and a hunting and pest control rifle second. The HW97 is well known for quality and top accuracy. With a good aftermarket tune the HW97 becomes a top-grade rifle for field target, and directly competes with the TX200 from Air Arms. My tuned HW97's all displayed good accuracy and repeatability, while maintaining about the same hold sensitivity as my two-tuned TX200 Mk III's.

The Beeman HW97 (along with several other Beeman models) incorporates the famous German made Rekord trigger. Early variations of the Rekord trigger were installed on airguns, such as the 1950's HW 35 and HW55 models. Basically, the Rekord is a high quality multi-lever two-stage steel and aluminum trigger housed in a steel box. The Rekord trigger is shooter adjustable for the second-stage weight of pull. Any further trigger adjustments should be made only by fully trained competent airgunsmiths. Personally, I never perform my own trigger tunes, or modifications, because I don't

wish to take any chances on having a trigger malfunction and possibly causing an accidental discharge.

Ken Reeves informs me that early models of the HW97 that were destined to be imported into England through the Hull Cartridge Company featured a premium aftermarket mainspring known as an OX spring. The top rated OX spring is a square section spring known for longevity and butter smooth operation. However, the version that Beeman Airguns imported featured a less costly stock factory Weihrauch spring. Some shooters thought all HW97 models had the upgraded OX spring, and when they had their Beeman models serviced they discovered otherwise. This evidently caused some confusion through the years, and some shooters still think the Beeman imported HW97 incorporates an OX spring.

Ken Reeves also went on to say the original company that made the OX Spring (GunSport Co.) is no longer in business. However, a group of employees formed a partnership and bought the company, which is again producing a premium but more costly airgun mainspring known as the OX Accelerator.

The newer HW97 Mark III version features a higher comb stock and a shorter overall length and is slightly lighter in weight.

I also own a pair of older HW97s with the longer barrel and different stock, which I use as loaner air rifles and lend them, when needed, to shooters who are new to the sport of field target.

TEST RESULTS/ Oehler 35P Chronograph/ about 6 inches from start screen

Factory Beeman HW 97 Mk III .177

Pellet tested: .177 caliber 7.9 grain Crosman

Premier

Velocity:

Hi	853	fps
Low	830	fps
ES	023	fps
SD	006	fps
Avg.	843	fps
Energy	12.46	foot pounds

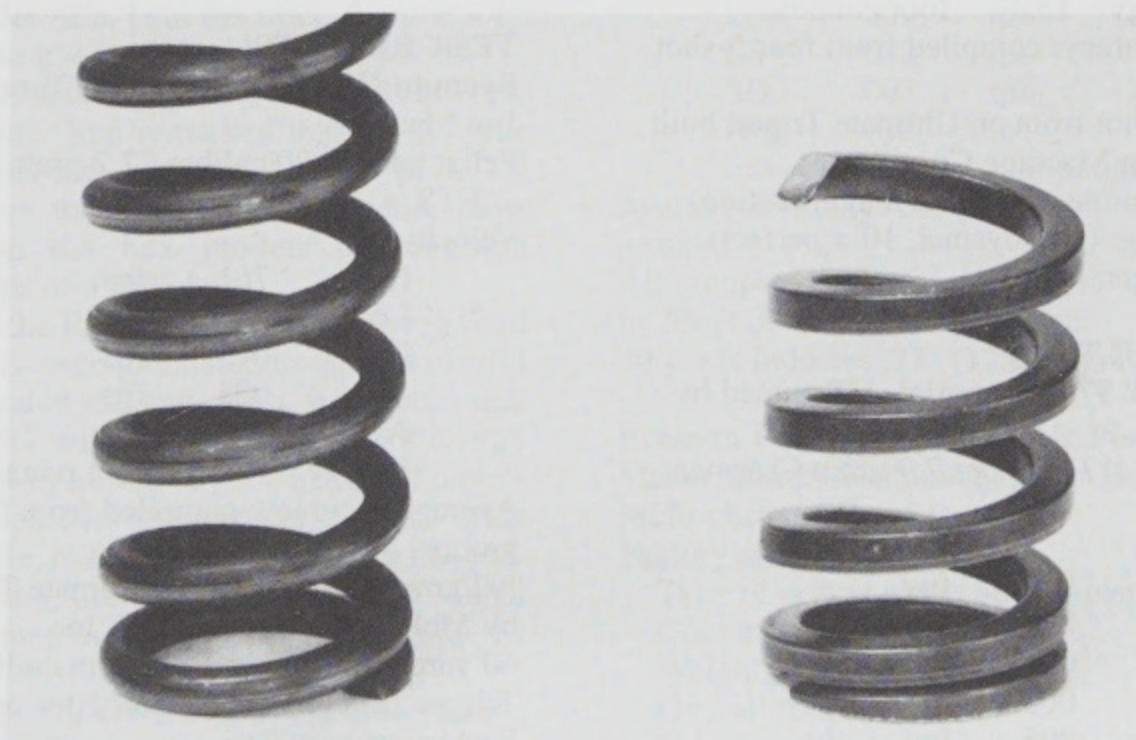
Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .54" (24X magnification)

Trigger rating (1= abysmal, 10 = perfect)

Factory trigger: 7



Left, an airgun mainspring from a Beeman imported HW97. Right, a small sample of a square section spring known as an OX mainspring, which came from the innards of a British imported HW97.

TEST RESULTS/

Beeman HW 97 Mk III .177 (Venom power tune by Mac-1)

Pellet tested: .177 caliber 7.9 grain Crosman Premier

Velocity:

Hi	921	fps
Low	907	fps
ES	014	fps
SD	004	fps
Avg.	914	fps
Energy	14.65	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .53" (24X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 8

Factory trigger: 7

TEST RESULTS/

Factory Beeman HW 97 Centennial .177

Pellet tested: .177 caliber 7.9 grain Crosman Premier

Velocity:

Hi	897	fps
Low	843	fps
ES	054	fps
SD	013	fps
Avg.	868	fps
Energy	13.21	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .60" (24X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 7

TEST RESULTS/

Beeman HW 97 Centennial .177 (tuned by Ken Reeves)

Pellet tested: .177 caliber 7.9 grain Crosman Premier

Velocity:

Hi	902	fps
Low	890	fps
ES	012	fps
SD	003	fps
Avg.	895	fps
Energy	14.05	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .49" (24X magnification)

Trigger rating (1= abysmal, 10 = perfect)

Factory trigger: 7

As tuned: 9

TEST RESULTS/

Beeman HW 97 Millennium .20 Caliber

(Tuned by Jim Maccari)

Pellet tested: .20 caliber 14.3 grain Crosman Premier

Velocity:

Hi	704	fps
Low	694	fps
ES	010	fps
SD	002	fps
Avg.	697	fps
Energy	15.42	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .50" (24X magnification)

Soap penetration test: 10 yards

Premiers = 4 to 4.25 bars of Ivory soap

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 7+

As tuned: 8+

TEST RESULTS/

Beeman HW 97 Millennium (Tuned by Jim Maccari)

Pellet tested: .20 caliber 12.2 grain Beeman FTS

Velocity:

Hi	761	fps
Low	746	fps
ES	015	fps
SD	004	fps
Avg.	750	fps
Energy	15.24	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .68" (24X magnification)

Trigger rating (1= abysmal, 10 = perfect)

Factory trigger: 7+

As tuned: 8+



The mild Beeman R7 is a good choice as a high quality beginner's air rifle.

Beeman R7 .177

Manufacturer: Weihrauch, Hans-Hermann,
Mellrichstadt, Germany

Factory specifications

Type of power plant: Spring-piston

Cocking method: Break-barrel

Weight: 6.1 pounds

Overall length: 40.2"

Velocity: 700 fps in .177, 620 fps in .20 caliber

Cocking effort: 18 pounds

The Beeman R7 is highly regarded as a very high quality beginner's pellet rifle. I originally bought a new R7 for my 10 year old son, Alan, to use for the shooting game of field target. After hearing raves about the R7 as a great youth rifle, I mistakenly thought the stock was proportioned for younger shooters. However, after measuring the length of pull at a full 14 $\frac{3}{8}$ inches I now believe the R7 is made for adults who prefer a low power lightweight, smooth shooting and accurate, adult size pellet rifle. I cut the stock down to a 12 $\frac{1}{2}$ inch pull, so it would better fit Alan's body.

The R7 was sent straight off to Ken Reeves for a standard tune. Ken remarked that my R7 was hotter than normal, because it could push 7.9 grain Premiers to almost 650 fps, while most straight from the box models chronograph around 600 fps or a little less.

Alan used the R7 most of his first year in field target, but has since graduated to more powerful and sophisticated models. Alan discovered that the Beeman R7 with its 7 foot pounds of energy is a little light as a field target rifle. Field targets that were much over 40 yards in distance often failed to topple, even with a direct hit to the paddle. I installed a Simmons Pro Air 4-12X-40mm scope in Beeman mounts.

TEST RESULTS/ Oehler 35P Chronograph/ about 6 inches from start screen

Beeman R-7 (tuned by Ken Reeves)

Pellet tested: .177 caliber 7.9 grain Crosman
Premier

Velocity:

Hi	654	fps
Low	635	fps
ES	019	fps
SD	005	fps
Avg.	644	fps
Energy	7.27	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .64" (12X magnification)

Cocking effort: 21 pounds

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 8+

TEST RESULTS/

Beeman R-7 (tuned by Ken Reeves)

Pellet tested: .177 caliber 8.7 grain Beeman FTS

Velocity:

Hi	621	fps
Low	609	fps
ES	012	fps
SD	003	fps
Avg.	613	fps
Energy	7.26	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .77" (12X magnification)

Beeman P1 Magnum .177 Air Pistol

Manufacturer: Weihrauch, Hans-Hermann,
Mellrichstadt, Germany

Factory specifications

Type of power plant: Spring-piston

Cocking method: Overlever

Weight: 2.5 pounds

Overall length: 11"

Velocity: 380-600 fps in .177, 350-500 fps in
.20 caliber

Cocking effort: 18 pounds

Beeman P3 .177 Air Pistol (Weihrauch HW40PCA)

Manufacturer: Weihrauch, Hans-Hermann, Mellrichstadt, Germany.

Factory specifications

Type of power plant: Pneumatic

Cocking method: Overlever

Weight: 1.7 pounds

Overall length: 9.6"

Velocity: 410- fps in .177

Cocking effort: 27 pounds

Beeman P1 and P3 Pistols

The Beeman P1 air pistol is a high quality dual power, spring-piston machine. The P1 is fashioned after the legendary Colt .45 Auto, but it is

not a replica. I would call it a quasi replica of the .45 Auto. In fact, Colt .45 grips fit the Beeman P1 just fine, and it appears that many Colt .45 owners really dote on the P1 as a home practice pistol. I personally know several law enforcement officers who own and shoot the Beeman P1.

The hammer on the P1 is actually a release for the over-lever cocking arm. The P1 is cocked with one stroke, but the shooter has the choice of cocking all the way for full-power, or stopping at the first cocking point for low-power. Once the cocking lever is up, the shooter places a pellet directly into the barrel; next the lever is closed and locked down with the hammer, and the pistol is ready to shoot. The trigger is an adjustable two-stage unit that is factory set for a 28 ounce pull. My personal pistol releases with only 22



The Beeman P1 Magnum air pistol.

— Photo courtesy of Beeman Precision Airguns.



The Beeman P3 is a modern pneumatic powered air pistol.

— Photo courtesy of Beeman Precision Airguns.

ounces of pressure, according to my trigger-pull gage.

The P1 has enough power to cleanly dispatch rats and other short-range pests, and it is quiet enough for home basement shooting. The P1 seems easy to cock with its 18 pound cocking effort, and even my ten-year old son can manage it. Not so with my Beeman P3, which is pneumatic powered and has a cocking effort of 27 pounds.

The Beeman P3 is a modern light-weight (1.7 pounds) polymer wrapped pneumatic target pistol. I would select the P3 over the P1 if I placed more emphasis on target shooting. The P3 loads very much like its older sibling the P1, but of course the shot cycle is recoil free because it is pneumatic powered. Because the P3 has a factory velocity rating of only 410 fps, I would refrain from shooting at most critters with it, except perhaps mice and grasshoppers.

TEST RESULTS/ Oehler 35P Chronograph/ about 6 inches from start screen

Beeman P1 Pistol

Pellet tested: .177 caliber 7.9 grain Crosman

Premier

Velocity: Hi power setting

Hi	515	fps
Low	496	fps
ES	019	fps
SD	006	fps
Avg.	503	fps
Energy	4.44	foot pounds

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 8

5-shot groups from a padded rest at 7 yards indoors averaged .52"

TEST RESULTS/ Oehler 35P Chronograph/ about 6 inches from start screen

Beeman P3 Pistol

Pellet tested: .177 caliber 8.09 grain H&N

Finale Match

Velocity:

Hi	379	fps
Low	336	fps
ES	043	fps
SD	011	fps
Avg.	365	fps
Energy	2.39	foot pounds

5-shot groups from a padded rest at 7 yards indoors averaged .40"

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 8+

TEST RESULTS/

Beeman P3 Pistol

Pellet tested: .177 caliber 7.9 grain Crosman

Premier

Velocity:

Hi	358	fps
Low	344	fps
ES	014	fps
SD	005	fps
Avg.	352	fps
Energy	2.17	foot pounds

5-shot groups from a padded rest at 7 yards indoors averaged .46"

AIRGUNS from CROSMAN Air Guns

Challenger 2000 .177 CO₂ Three-position precision target rifle

Manufacturer: Crosman Air Guns, East Bloomfield, NY

Factory specifications

Type of power plant: CO₂

Cocking method: bolt action single-shot

Weight: 6.95 pounds

Overall length: 36.25"

Barrel length: 19"

Velocity: 485 fps, Adjustable synthetic stock.

The Crosman Challenger 2000 is a great leap forward towards easy to shoot three-position youth target rifles. Members of the USA Shooting Team have fully endorsed the Challenger 2000. A fully adjustable stock adds to the versatility of this easy to cock air rifle. I discovered the stock's length of pull adjusts from 12-3/8 to about 15 inches.

The Challenger comes with a fully adjustable diopter rear sight. However the receiver is also grooved to accept standard airgun scope mounts. The two stage trigger was somewhat of a surprise, as it broke cleanly and consistently at 2.5 pounds

My first thought about this new Crosman was that it might prove to be a good beginner's rifle for BRV competition (which has since permeated into BR 4000 competition). My son, Alan, accepted the challenge (no pun intended) and we attached a Simmons Pro Air 6-18X scope and zeroed the rifle at 22 yards. While shooting and testing during a 72°f day, we discovered that over 70 shots were possible from one CO₂ cartridge, but for competition shooting we planned to limit our shots to 50 for improved consistency. The day of the BRV match the temperature dipped below 40°f which resulted in a sub par performance, and I believe Alan would have done much better if it



The Crosman Challenger 2000 proved to be an accurate youth to teenager sized target rifle.



Alan Hanson testing the Crosman Challenger 2000 from a bench rest at 22 yards.

was some twenty to thirty degrees warmer.

If you are looking into a youth-to-large teenager sized rifle for training purposes or merely for backyard plinking, the Crosman Challenger is a dandy.

**TEST RESULTS/ Oehler 35P Chronograph/
about 6 inches from start screen**

Crosman Challenger 2000 .177 CO₂

Pellet tested: .177 caliber 7.9 grain Crosman Premier

Velocity: 72°F (15 shot string, 15-second interval between shots)

Hi	507	fps
Low	486	fps
ES	021	fps
SD	005	fps
Avg.	498	fps
Energy	4.35	foot pounds

Average accuracy: compiled from three 5-shot groups from a bench rest.

22 yards outdoors (variable winds-2 to 8 mph) = .46" (18X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

Factory: 8

CROSMAN 2260 CO₂ Rifle Single Shot Bolt Action

Manufacturer: Crosman Air Guns, East Bloomfield, NY

Factory specifications

Type of power plant: CO₂ Cartridge

Cocking method: bolt action single-shot

Weight: 4.75 pounds

Overall length: 39.75"

Barrel length: 24"

Velocity: Up to 600 fps, American hardwood stock.



The author's Crosman 2260 with a Weaver 2.5-7X Rimfire scope.

The Crosman 2260 is somewhat of a reincarnation of the famous Crosman model 160. The current 2260 requires only one CO₂ cartridge, whereas the older discontinued model 160 required two cartridges, but puts out higher velocity. The 2260 also incorporates a less costly plastic trigger. The factory two-stage trigger broke with a touch of creep at 5 pounds. The gas cartridge had enough endurance to give us 22 to 24 shots, but for the utmost in consistency we kept our testing to 15 shots per cartridge.

My son Alan and I discovered that the model 2260 has enough velocity to dispatch rats and short range ground squirrels. When tested indoors at 10 yards with the factory open sights, it was easy to keep five shot groups of 14.3 grain Crosman Premiers under ½ of an inch. No doubt that a scope would improve that accuracy. Using Crosman model 459MT clamp-on scope mounts, I installed a Weaver 2.5-7X-28mm Rimfire scope. Testing again with Premiers indoors at 10 yards with the scope attached and adjusted at 4 power, the gun printed groups that hovered around .34 to .42 of an inch.

The Crosman 2260 should prove to be a good bet as an inexpensive pest eliminator and general plinker, and junior shooters will find it is easy to load and shoot.

TEST RESULTS/ Oehler 35P Chronograph/ about 6 inches from start screen

Crosman 2260 .22 CO₂

Pellet tested: .22 caliber 14.3 grain Crosman Premier

Velocity: 70°f (15 shot string, 15-second interval between shots)

Hi	567	fps
Low	537	fps
ES	030	fps
SD	009	fps
Avg.	554	fps
Energy	9.74	ft. lbs

Trigger rating: (1= abysmal, 10 = perfect)

Factory: 5

DENNIS QUACKENBUSH Modified CROSMAN 2240

CO₂ Pistol .25 & .20 Caliber Guns Tested

Manufacturer: Crosman Air Guns, East Bloomfield, NY

Modified by Dennis Quackenbush

417-993-5262 CST

Specifications

Type of power plant: Gas, one CO₂ cartridge

Overall length: 14" for the .25 caliber with a 10" barrel. The .20 caliber version is 13" overall and has a 9" barrel.

Weight: about 36 ounces.

Dennis Quackenbush, an airgunsmith from Missouri, came out with his own modified versions of the Crosman 2240. The modified versions feature a steel breech and a left-hand bolt, which is the correct setup for right handed shooters. Triggers on my guns were slightly creepy and released at just under 4 pounds. Dennis makes his own button rifled steel barrels. The .25 caliber barrel was designed to shoot the 21 grain RWS Diana Magnum pellet.

I installed a Crosman laser sight on the .25 caliber version for rat shooting. For my .20 caliber version I decided to go with a BSA red dot sight.



The author's Dennis Quackenbush modified .20 caliber Crosman 2240 CO₂ powered pistol with a BSA Red Dot sight.



The author's .25 caliber Crosman 2240 modified by Dennis Quackenbush.

I discovered both of these pistols are effective rat killers, but the .25 caliber would probably be my first choice because of its extra energy output.

For the .20 caliber gun I selected to shoot Beeman Field Target Special pellets. There are not many choices with the .25 caliber pistol, because you're pretty much restricted to shooting the 21 grain Diana Magnum. (Unless you can locate a quantity of another brand of light weight .25 caliber pellets). Both pistols seem capable of fine accuracy, and I was able to print 5-shot groups that hovered between .28 to .33 of an inch from a padded rest at 7 yards indoors.

TEST RESULTS/ Oehler 35P Chronograph/ about 6 inches from start screen

Quackenbush .20 Caliber Modified Crosman CO₂

Pellet tested: .20 caliber 12.2 grain Beeman FTS

Velocity: 74°f (15 shot string)

Hi	499	fps
Low	481	fps
ES	018	fps
SD	006	fps
Avg.	490	fps
Energy	6.50	foot pounds

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 6

TEST RESULTS/Quackenbush .25 Caliber Modified Crosman CO₂

Pellet tested: .25 caliber 21 grain Diana

Magnum

Velocity: 74°f (15 shot string)

Hi 471 fps

Low 450 fps

ES 021 fps

SD 008 fps

Avg. 463 fps

Energy 9.99 foot pounds

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 6

AIRGUNS from RWS INC. (DYNAMIT NOBEL)**Model 54 Recoilless Side-Cocking Magnum**

Manufacturer: Dianawerk, Mayer and

Grammelspacher, Rastaff, Germany

Factory specifications: Recoilless sledge system

Type of power plant: Spring-piston

Cocking method: Side-lever

Weight: 9 pounds

Overall length: 43"

Velocity: 1100 fps (.177), 900 fps (.22)

Cocking effort: 39 pounds

In 1993 RWS started the importation of the "new" model 54 from Dianawerk. The RWS 54 still remains near the top of the heap in popularity of high power spring-piston air rifles. Normally, when one conjures up thoughts of shooting a new high power spring-piston rifle you have an expectation and a mind-set of moderate to strong piston recoil. If you are not prepared, the model 54 will be a nice surprise for you! What sets this gun apart is that it uses a sledge system of recoil dampening. Yes, the usual spring jump is gone, and the shooter is able to more easily concentrate on his intended target, instead of riding out the effects of the spring and piston.

The entire receiver, including the trigger, rides

on a steel rail system, and when a pellet is propelled down the bore, the action rides backwards (about ½ inch) inside the stock to dampen the felt recoil. Most experienced airgun aficionados would not truly consider this system a true recoil suppression system, but only a dampening system, because you can feel some movement. Also, be aware that if you have a scope attached it too will slide back with the action. Therefore, use caution when mounting a scope so that it will not come back to "bite" you in the eyebrow.

The sledge system of recoil dampening has always been considered by the British publications and Air Arms (makers of the TX200 SR) as a semi-recoiling system, but the RWS model 54 is pushed in the states as a totally recoilless air rifle. Don't read me wrong here as the sledge system does work well, and it is also regarded as the most cost effective and the least complicated way to build a "recoilless" airgun.

Currently I own two versions of the RWS 54, one in .177 and another in .22 caliber. Both of mine, when new, were dieseling rather profusely and had rather creepy triggers, so I shipped them off to my old friend Ken Reeves for tune-ups. Along with trigger tunes, Ken also recommended for longer spring life that the factory mainsprings should be replaced with premium aftermarket springs. I gathered from Ken that the RWS models 48, 52 (which are the regular recoiling models) and the model 54 are somewhat notorious for early mainspring failures. According to Ken, the reason these models suffer from premature spring retirement is that the factory springs are overstressed for the duty placed on them, but some improvement has been noted in this regard with the newer models. These RWS side-cocking models are known for high velocity and put out considerable energy in factory guise.

The only downside to Ken's recommended tunes meant, in all probability, I would lose a bit of velocity in the process. I was hoping when the tunes were completed I would not lose any real significant amount of velocity. A tune featuring a



Above, an RWS model 54 recoilless air rifle.
— Photo courtesy of Gazebo Advertising.



Above, an RWS model 48B Bipod Model. Note that the open sights are absent because this model was designed for scope use.

— Photo courtesy of Gazebo Advertising.

longer lasting and more trouble free gun would certainly be worth some lost velocity. As it turned out, I really didn't have too much to worry about.

In factory guise my .22 caliber RWS 54 propelled a 14.3 grain Premier to an average velocity of 798 fps. In tuned condition the same gun propelled the same pellet to an average 776 fps, which meant I lost only 22 fps. In factory guise my model 54 in .177 pushed a 7.9 grain Premier to a rather speedy average velocity of 1,022 fps. When tested again in tuned condition the same gun propelled the same pellet to an average 957 fps, which meant I lost 65 fps, but the gun also gained some accuracy in the process. My guess is that the Crosman Premier pellet in my particular gun didn't exactly care to be pushed to 1,022 fps, and that a slightly more sedate velocity range of around 957 fps smoothed the flight characteristics, and the pellet became more stable. After further testing, I discovered the .177 caliber 10.5 grain Premier was the most accurate and became my pellet of choice. I also discovered that the 10.5 grain Crosman Premier dispatches crows rather effectively too.

The RWS air rifle series models 48, 52, and 54 are occasionally found on the field target circuit, but because of their higher than average power output they more commonly find favor with the suburban airgun hunter.

**TEST RESULTS/ Oehler 35P Chronograph/
About 6 inches from start screen
Factory RWS model 54 Recoilless /.22
Caliber**

Pellet tested: .22 caliber 14.3 grain Crosman Premier

Velocity:

Hi	815	fps
Low	781	fps
ES	034	fps
SD	009	fps
Avg.	798	fps
Energy	20.22	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .72" (12X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 6

TEST RESULTS/

RWS model 54 Recoilless /.22 Caliber (tuned by Ken Reeves)

Pellet tested: .22 caliber 14.3 grain Crosman Premier

Velocity:

Hi	785	fps
Low	768	fps
ES	017	fps
SD	005	fps
Avg.	776	fps
Energy	18.63	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .69" (12X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 8

Factory trigger: 6

TEST RESULTS/**Factory RWS model 54 Recoilless/ .177 Caliber**

Pellet tested: .177 caliber 7.9 grain Crosman Premier

Velocity:

Hi	1041	fps
Low	991	fps
ES	050	fps
SD	013	fps
Avg.	1022	fps
Energy	18.32	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .88" (12X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 6

TEST RESULTS/**RWS model 54 Recoilless / .177 Caliber**

(tuned by Ken Reeves)

Pellet tested: .177 caliber 7.9 grain Crosman Premier

Velocity:

Hi	972	fps
Low	935	fps
ES	037	fps
SD	009	fps
Avg.	957	fps
Energy	16.06	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .71" (12X magnification)

Soap penetration test: 10 yards

Premiers = 3.2 bars of Ivory soap

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 8

Stock trigger: 6

TEST RESULTS/**RWS model 54 Recoilless / .177 Caliber**

(tuned by Ken Reeves)

Pellet tested: .177 caliber 10.5 grain Crosman Premier

Velocity:

Hi	807	fps
Low	786	fps
ES	021	fps
SD	007	fps

Avg. 794 fps

Energy 14.7 foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .63" (12X magnification)

Soap penetration test: 10 yards

Premiers = 3.8 bars of Ivory soap

Cocking effort: 36 pounds

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 8

TEST RESULTS/**Factory RWS 48 .20 Caliber**

Pellet tested: .20 caliber 14.3 grain Crosman Premier

Velocity:

Hi	788	fps
Low	767	fps
ES	021	fps
SD	008	fps
Avg.	774	fps
Energy	19.02	foot pounds

Tested rifle for velocity only.

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 6+

TEST RESULTS/**Factory RWS 48 .177 Caliber**

Pellet tested: .177 caliber 10.5 grain Crosman Premier

Velocity:

Hi	879	fps
Low	860	fps
ES	019	fps
SD	006	fps
Avg.	870	fps
Energy	17.65	foot pounds

I tested rifle for velocity only.

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 6

RWS 46 (STUTZEN Version) .177 Caliber

Manufacturer: Dianawerk, Mayer and

Grammelspacher, Rastaff, Germany

Factory specifications

Type of power plant: Spring-piston

Cocking method: Under lever

Weight: 8.6 pounds

Overall length: 45"

Velocity: 950 fps (.177)

Cocking effort: 33 pounds

I had never owned a stutzen style rifle, but I always had a soft spot for one in my collection. While at a gun show, I spotted a new RWS 46 with a stutzen stock on Darrell Schenk's table ... well, how could I resist?

Somehow, the RWS 46 Stutzen found its way to my home and became part of my ever growing airgun collection. Eager to see what it could do, I immediately cleaned the barrel and tested it for velocity. My expression turned from wonderment to disbelief when the low velocity and huge extreme spreads flashed from my Oehler. Eventually, I discovered the flip-up loading port seal was missing and this was a large part of the problem. The gun was also noticeably dieseling, so I decided to send it off to Ken Reeves for a tune.

Ken corrected a host of problems with my model 46 Stutzen. But now the tuned RWS 46 shoots very well, and my son Alan has taken a liking to it and has also expressed his desire to try it out for field target competition. I installed a Simmons Pro Air 6-18X-40mm scope, which seems to be performing just fine.

TEST RESULTS/ Oehler 35P Chronograph/ about 6 inches from start screen

Factory RWS 46 Stutzen .177 Caliber

Pellet tested: .177 caliber 7.9 grain Crosman

Premier

Velocity:

Hi	730	fps
Low	693	fps
ES	037	fps
SD	011	fps
Avg.	707	fps
Energy	8.77	foot pounds

Did not conduct accuracy tests because loading port seal was missing

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 5

TEST RESULTS/

RWS 46 Stutzen .177 Caliber (tuned by Ken Reeves)

Pellet tested: .177 caliber 7.9 grain Crosman

Premier

Velocity:

Hi	825	fps
Low	812	fps
ES	013	fps
SD	003	fps
Avg.	817	fps
Energy	11.71	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .66" (18X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 5

As tuned: 8

RWS MODEL 710 TANKER PCP CARBINE (Also known as the RWS-CAREER Tanker Carbine)

Manufacturer: Shinsung Industries Co., Ltd.

Buchon-City, Kyungki-Do, Korea

Factory specifications

Type of power plant: Pre-charged pneumatic

Cocking method: Lever action repeater

Weight: 7 pounds

Overall length: 34.5"



Top, an RWS model 46, bottom, author's .177 caliber RWS 46 Stutzen showing the flip-up loading port.



Top and bottom, the RWS model CA710T pre-charged carbine.

Barrel length: 16"
Interchangeable air cylinder.

I had visions of long-range airgun varmint hunting when I purchased two RWS 710-T carbines. I chose two different caliber versions of the same gun (.22 and .25) to get a feeling for each and to determine if one caliber had an advantage. I have shot many pre-charged rifles during the past few years, but never made a commitment to buying one until I came across these two Career models, then I went all out and bought both rifles.

These Career carbines are lever action repeaters that use detachable spring loaded magazines. The .22 caliber magazines hold six pellets, while the .25 caliber version will accept up to seven pellets. The pellet feed mechanism is adjustable and the instructions that came with the gun describe how to adjust it to feed shorter pellets, such as the Crosman Premier. Both of my carbines have two-stage triggers, which are somewhat creepy and release with around five pounds of pull.

Not having scuba gear to charge my new pre-charged rigs, I decided to buy the accompanying high-pressure hand pump. Connecting the hand pump without leaking air required a modest amount of "plumbers" tape that had to be wrapped around the threads of the connectors. The pump requires about 150-160 pumps to fully charge the interchangeable aluminum air reservoir. A spring-loaded quick disconnect device

holds the reservoir in place. With hunting in mind I believe detachable air reservoirs are invaluable.

After about six months of use, my hand pump stopped working and had to be sent back to RWS for repairs. This happened at a most inopportune time, as I was just leaving on a five day varmint hunting jaunt into Montana. Shortly after I received a new hand pump from RWS, my .25 caliber 710-T carbine refused to hold a charge, and it had to be sent back for repairs. All the lost time for repairs meant I did not have a chance to get real familiar with my two Career carbines, as I would have liked. Overall it was a less than an imposing first impression for the brand.

Evidently the Shinsung factory has three different power levels that they set their Career rifles for. Both of mine were of the high power persuasion and were setup to feed the heavy Korean pellets called Dae Sung. The model 710-T airguns have an adjustable power wheel that features three main settings and several sub-settings. In order to obtain more shots per charge, I decided to conduct my tests using the basic low power setting, which is color coded green. Tests revealed that about 30 to 35 useable shots were possible per fill, but the first 15 shots were the most consistent.

I weighed samples of my selected calibers of Dae Sung pellets using my Denver Instrument electronic scale. My scale determined that one batch of .22 caliber Dae Sung pellets weighed a consistent 28.5 grains, while another batch weighed 27.5 grains. The .25 caliber Dae Sung



Alan Hanson shooting ground squirrels with author's RWS 710T pre-charged carbine.

pellets weighed in at a hefty average weight of 35 grains. Tests conducted at 10 yards revealed that the 28.5 grain .22 caliber Dae Sung pellet has a ballistic coefficient of .046, while limited testing with the .25 caliber version (I was running low on air) revealed it has a ballistic coefficient of .035. My ballistic coefficient tests suggested to me that my .22 caliber version would be a more effective long-range air rifle. By the way, both the .25 and the .22 caliber Dae Sung pellets out-penetrated a .22 Long Rifle hollow point bullet, when tested at 20 yards into Ivory soap bars!

After a couple of field trips where I shot both rifles at various critters, I have come to the conclusion that my .22 caliber version is a more effective and accurate critter killer. My .25 caliber version, shooting the heavy 35 grain Korean dome pellets, kills very well out to around 65-70 yards. Once I managed to stretch the range and kill a rockchuck at a laser ranged 80 yards. The .25 caliber seems to be handicapped with lower initial velocity and a lower ballistic coefficient, which results in a more pronounced loopy trajectory.

While shooting Montana ground squirrels with my .22 caliber version, I made many kills over 75 yards and made a most memorable head shot kill at 104 yards, which remains my longest kill to date with my .22 RWS 710-T. I have also used my .22 caliber version to kill a few marauding crows out to 80 yards.

I also discovered there is a potential noise problem with these pre-charged rigs. A couple of times, while shooting these air rifles, I was ques-

tioned by suburban mini-ranchette owners if I was shooting a rimfire rifle, which was not allowed by these land owners. I had to try to explain that my carbine was indeed powered by air. It just happens to be a louder type than most airguns. One rancher said it was okay for me to continue shooting, while another rancher said my gun was too loud and made his wife nervous, so I had to stop shooting it.

TEST RESULTS/ Oehler 35P Chronograph/ about 6 inches from start screen

RWS 710T .22 Caliber (full charge)

Pellet tested: .22 caliber 28.5 grain Dae Sung
Velocity: At the green (low) power level (15 shots from a full tank)

Hi	856	fps
Low	812	fps
ES	044	fps
SD	013.7	fps
Avg.	832	fps
Energy	43.98	foot pounds

Average accuracy: compiled from three 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .55" (12X magnification)

75 yards outdoors: 1.36"

Soap penetration test: 20 yards

Premiers = 10.5 to 11 bars of Ivory soap

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 5

TEST RESULTS/**RWS 710T .25 Caliber (full charge)**

Pellet tested: .25 caliber 35 grain Dae Sung

Velocity: At the green (low) power level (15 shots from a full tank)

Hi	823	fps
Low	770	fps
ES	053	fps
SD	015.4	fps
Avg.	793	fps
Energy	48.88	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .71" (12X magnification)

75 yards outdoors: 1.93"

Soap penetration test: 20 yards

Premiers = 9 bars of Ivory soap

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 5

AIRGUNS FROM THEOBEN ENGINEERING**THEOBEN ELIMINATOR/ Imported in the U.S. as the Beeman Crow Magnum IV**

Manufacturer: Theoben Engineering, Cambridgeshire, England

Factory specifications (from Beeman)

Type of power plant: Gas-spring

Cocking method: Break barrel

Weight: 8.6 pounds

Overall length: 46"

Velocity: 1,060 fps (.20), 935 fps (.22), 815 fps (.25)

Cocking effort: 60 pounds

The .22 caliber is fitted with an Anschutz barrel, while the .20 and .25 calibers are fitted with selected Walther barrels.

I purchased my Theoben Eliminator straight across the big pond from Theoben Engineering in England. Designed as a high-power hunting rig, the gas-ram powered Eliminator puts out significant hot air and velocity. (Beeman imports a slightly different-stocked version known as the Crow Magnum IV.)

Although I don't know the exact reasons why, the .20 caliber was said (from several sources) to be the best choice with this particular air rifle. Theoben Engineering states the Eliminator should be able to push the .20 caliber Premier to around the 880 fps range. My own personal gun came close to that figure and clocked 867 fps as an average. However, later I lapped the barrel with J-B bore cleaning compound, and my velocity dropped a tad to 855 fps.

As compared to tests conducted by several air-gun writers over the years, my own personal Eliminator seems be slightly lacking in the velocity department. However, I am not complaining and have a theory that the factory might have intentionally lowered the velocity in order to improve upon accuracy and consistency.

The gas-ram feature means that hunters never have to worry about leaving the gun cocked, as the invisible air spring cannot weaken. No factory sights are installed, as this rig is intended from the get-go to be a scoped rifle. The two-stage trigger on my rifle released very crisply with 20 ounces of pull. The Eliminator is rated with a cocking effort of 60 pounds, but my rifle requires only 50-51 pounds of effort according to my Health-O-Meter bathroom scale. Cocking effort is stout, but it should be nothing to worry about if you are a reasonably fit male, or a very strong female.

I bought my Eliminator with the intention that it be used for medium and long-range varmint hunting. So far, I have no complaints about its performance. In fact, newcomers to the sport of



The Theoben Eliminator (a.k.a. Beeman Crow Magnum IV) remains a popular very high-power gas-ram air rifle.

— Photo courtesy of Theoben Engineering.

long-range air rifle hunting have been very impressed. My longest shots have eclipsed the 100 yard marker, as I have cleanly dispatched several ground squirrels and rockchucks with head shots.

TEST RESULTS/ Oehler 35P Chronograph/ about 6 inches from start screen

Theoben Eliminator .20 Caliber (a.k.a. Beeman Crow Magnum IV)

Pellet tested: .20 caliber 14.3 grain Crosman Premier

* Pellets lightly lubed with a 50% / 50% mixture of STP engine oil treatment and Hoppes Number 9 lubricating oil.

Velocity:

Hi	873	fps
Low	860	fps
ES	013	fps
SD	008	fps
Avg.	866	fps
Energy	23.81	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .60" (24X magnification)

Soap penetration test: 10 yards

14.3 Premiers = 6.75 bars of Ivory soap

Cocking effort: 50-51 pounds

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 9

TEST RESULTS/

Theoben Eliminator .20 Caliber (a.k.a. Beeman Crow Magnum IV)

Barrel lapped with J-B Bore cleaning compound

Pellet tested: .20 caliber 14.3 grain Crosman Premier

* Pellets lightly lubed with a 50% / 50% mixture of STP engine oil treatment and Hoppes Number 9 lubricating oil.

Velocity:

Hi	860	fps
Low	851	fps
ES	009	fps
SD	005	fps
Avg.	855	fps
Energy	23.21	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .52" (24X magnification)

75 yards outdoors: 1.28"

TEST RESULTS/

Theoben Eliminator (a.k.a. Beeman Crow Magnum IV)

Barrel lapped with J-B Bore cleaning compound

Pellet tested: .20 caliber 12.8 grain Beeman Crow Magnum

* Pellets lightly lubed with a 50% / 50% mixture of STP engine oil treatment and Hoppes Number 9 lubricating oil.

Velocity:

Hi	923	fps
Low	905	fps
ES	018	fps
SD	005	fps
Avg.	914	fps
Energy	23.74	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .65" (24X magnification)

Soap penetration test: 10 yards

12.8 grain Crow Magnum = 2.20 bars

(expanded to .322") of Ivory soap

TEST RESULTS/

Theoben Eliminator (a.k.a. Beeman Crow Magnum IV)

Barrel lapped with J-B Bore cleaning compound

Pellet tested: .20 caliber 12.2 grain Beeman FTS

* Pellets lightly lubed with a 50% / 50% mixture of STP engine oil treatment and Hoppes Number 9 lubricating oil.

Velocity:

Hi	1001	fps
Low	982	fps
ES	019	fps
SD	004	fps
Avg.	993	fps
Energy	26.71	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .71" (24X magnification)

TEST RESULTS/

Theoben Eliminator (a.k.a. Beeman Crow Magnum IV)

Barrel lapped with J-B Bore cleaning compound

Pellet tested: .20 caliber 13.3 grain Beeman Kodiak

* Pellets lightly lubed with a 50% / 50% mixture of STP engine oil treatment and Hoppes Number 9 lubricating oil.

Velocity:

Hi	874	fps
Low	860	fps
ES	014	fps
SD	005	fps
Avg.	865	fps
Energy	22.10	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .59" (24X magnification)

THEOBEN DUAL MAGNUM .22 Caliber
(Imported as the **BEEMAN DUAL MAGNUM**)

Manufacturer: Theoben Engineering,
Cambridgeshire, England

Factory specifications

Type of power plant: Gas-spring

Cocking method: Under lever, automatic pop-up loading port

Weight: 9 pounds

Overall length: 43.75"

Energy Output: One stroke = 25 ft/lbs. Two strokes = 36 ft/lbs.

The new Dual Magnum is Theoben's answer for those shooters who think they need two rifles in one. The Dual, in the name of this air rifle, aptly describes its ability to be two rifles in one. Cock it once and I have the energy output of a power-tuned Beeman R1; cock it twice and I

have a power level that approaches a target speed .22 short rimfire. The factory specifications do not list the cocking effort, but it seems to take less effort to cock this rifle two strokes, versus one stroke, on my Theoben Eliminator, although the two strokes take longer, time-wise.

I latched onto a hot new Dual Magnum straight from Theoben's first run. With long-range air rifle hunting in mind, I installed a new Mil-Dot equipped Bushnell 4200 series 6-24X-40mm scope. The Mil-Dots help aid me with long-range holdover and come into play with shots over about 80-85 yards in distance. So now, I have a versatile .22 caliber hunting rifle that absolutely won't weaken when cocked for extended periods and has nearly the power of a .22 short rimfire, or a high power pre-charged hunting air rifle.

I've used my Dual Magnum to take ground squirrels out to distances of 70 yards and rockchucks out to around 90 yards with head shots.

TEST RESULTS/ Oehler 35P Chronograph/
about 6 inches from start screen

Theoben Dual Magnum- Hi Power (two strokes)

Pellet tested: .22 caliber 14.3 grain Crosman

Premier

* Pellets lightly lubed with a 50% / 50% mixture of STP engine oil treatment and Hoppes Number 9 lubricating oil.

Velocity:

Hi	1020	fps
Low	1015	fps
ES	005	fps
SD	002	fps
Avg.	1017	fps
Energy	32.84	foot pounds

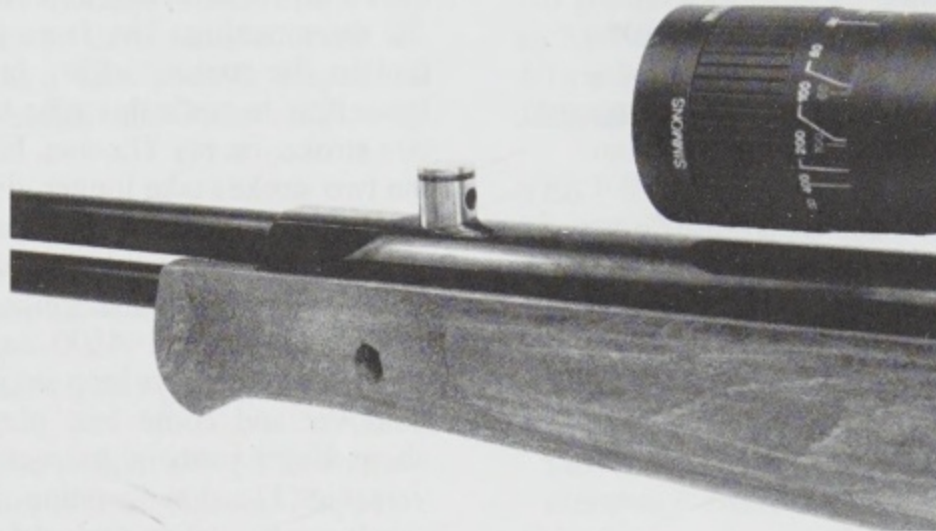
Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .64" (24X magnification)



The new Theoben Dual Magnum is unique among high power hunting air rifles.
— Photo courtesy of Theoben Engineering.



Close up view of the Dual Magnum showing the pop-up loading port, which by the way is coated with titanium nitride (TiN) for the utmost in wear resistance.

— Photo courtesy of Theoben Engineering.



Jim Benson testing author's Dual Magnum.

75 yards outdoors: 1.53"

Soap penetration test: 10 yards - high power

Premiers = 6.6 to 6.8 bars of Ivory soap

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 9

TEST RESULTS/

Theoben Dual Magnum- Low Power (one stroke)

Pellet tested: .22 caliber 14.3 grain Crosman Premier

* Pellets lightly lubed with a 50% / 50% mixture of STP engine oil treatment and Hoppes Number 9 lubricating oil.

Velocity:

Hi	839	fps
Low	832	fps

ES 007 fps

SD 002 fps

Avg. 835 fps

Energy 22.14 foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .54" (24X magnification)

TEST RESULTS/

Theoben Dual Magnum- hi power (two strokes)

Pellet tested: .22 caliber 21.1 grain Beeman Kodiak

* Pellets lightly lubed with a 50% / 50%

mixture of STP engine oil treatment and Hoppes Number 9 lubricating oil.

Velocity:

Hi	804	fps
Low	790	fps
ES	014	fps
SD	004	fps
Avg.	795	fps
Energy	29.61	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .51" (24X magnification)

75 yards outdoors: 1.22"

Soap penetration test: 10 yards

Beeman Kodiak = 6.6 to 6.7 bars of Ivory soap

32 grain Ultra-Mag = 6.8 to 6.9 bars of Ivory soap

WHISCOMBE JW80

Manufacturer: John Whiscombe, Berkshire, England

Factory specifications

Type of power plant: Recoilless Dual spring-piston

Cocking method: Under-lever

Weight: 10 pounds

Barrel Length 17", Interchangeable barrels

Velocity: 1,040 fps with .177 cal. 10.5 grain

Premiers; 910 fps with .20 cal. Premiers;

980 fps with .22 cal. Premiers; 870 fps

with .25 caliber 20 grain Diana Magnums.

Cocking effort: (three strokes) 20, 28, 39 pounds

From the mastermind of Englander John Whiscombe, comes his JW series (currently the JW50, JW65, and JW80) recoilless spring-piston air rifles. John has been at this game for many years, and has been fine-tuning and upgrading his design since the mid 1980's. The series numbers represent swept area in millimeters. The larger the swept area of air compression, the higher the velocity and thus the JW80 series puts out the most velocity.

The Whiscombe design uses two active pistons (no dummy pistons here) that converge into the transfer port and propel the pellet down the bore with no felt recoil or vibration. Do you remember the concept of equal and opposite forces negating each other? Dual coil springs provide the power and both pistons feature a lubricant reservoir that extends the lubrication intervals, with up to an incredible 30,000 firing cycles. The Whiscombe air rifles are an engineer's dream that became reality. If I am not mistaken, the Whiscombe series of air rifles are the only current recoilless spring-piston models that don't use a sledge system of recoil suppression. Whiscombe air rifles are essentially custom built by John Whiscombe, and the workmanship and finish is superlative.

The JW50 and JW65 require two under lever strokes, while the more powerful JW80 requires three strokes for operation. The cocking operation pulls back the rear piston, while a gear and ratchet system drives the front piston forward.

Operation is simple, however the correct sequence must be followed or you will get yourself in trouble. First, unlatch the cocking lever by releasing the catch at the front of the rifle. Next,



Author's Whiscombe JW80 FB MKII with a Tasco Tactical 8-40X scope and BKL rings and mounts.

draw down the lever until a click is heard, then return the lever to the original position. Continue the cocking operation until the gun is fully cocked, which depends upon which model you have. With the gun fully cocked, the trigger and the automatic safety are also engaged. Next, it is time to hand load a pellet by pulling back on a side lever, which retracts a heavy duty loading bolt. Now you have access to the breech loading area, and a pellet is gently inserted into the rear of the barrel. Next, return the side lever to its original position, and you are ready to shoot once you have released the safety.

The shooter must remember to cock the action before loading a pellet and closing the bolt; if this process is reversed, air will not be drawn past the sealed pellet and severe internal damage can occur, because there will be no air buffer between the converging piston heads.

Interchangeable barrels are also a part of the fascination of owning a Whiscombe rifle and add value to the versatility of the Whiscombe system. Changing barrels is a simple matter of loosening two screws and unscrewing the threaded barrel, which is also supported by a support yoke at the end of the compression tube. Barrels are currently from Lothar Walther (except for the .25 caliber barrel which is from BSA) and feature polygonal rifling for less pellet distortion.

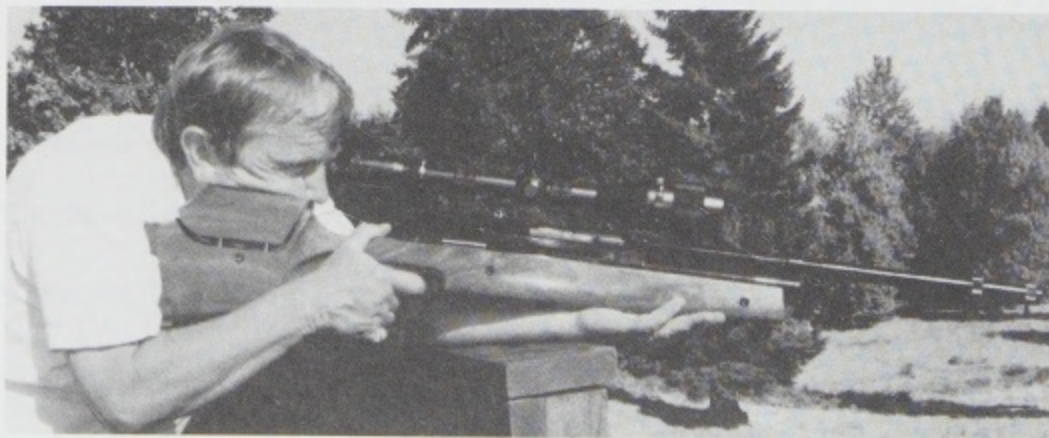
The muzzle end of each barrel also features what is called an adjustable H.O.T.S (Harmonic Optimization Tuning System) The H.O.T.S system provides the shooter a means of tuning barrel vibrations so that it can match the timing of a particular pellet for optimum accuracy. Spring-piston systems evidently generate enough harmonic vibration to affect accuracy to some degree, and this system essentially allows the

shooter a means to fine-tune the barrel harmonics. Firearm shooters are probably aware of the Browning BOSS system, which allows the shooter a means of adjusting the barrel's harmonics to match the ammunition for the best accuracy, and the HOTS system is based around the same principal.

I opted for the standard two stage trigger and have been perfectly satisfied with the crisp 8 ounce pull. However, for match shooters who love very light triggers there is an optional 2 ounce trigger available.

My .22 caliber Whiscombe was purchased for the primary purpose of medium to long-range varmint hunting. As far as optics for my JW80, I went with a Tasco Tactical 8-40X-56mm. In fact, I have had so much fun and success with my JW80 during hunting excursions I soon realized that I should try shooting Field Target with it. But after looking over a new JW65 that requires only two strokes to cock, I decided to go with it for Field Target, and save my JW80 for hunting safaris.

When I first started shooting my JW65 for Field Target, I thought that I would go with a .20 caliber barrel and shoot 14.3 grain Crosman Premiers. In my experience, the .20 caliber Premier has one of the highest ballistic coefficients, which should make it less sensitive to wind deflection, and that was the main reason for choosing the .20 caliber. However, I discovered that the prevailing winds are unusually mild at the local Field Target club where I do most of my shooting. Furthermore, the velocity at which I was pushing my .20 caliber Premiers (762 fps) was actually making holdover more of a problem than wind deflection. To make a long story short, I am in the process of changing over to a .177



Roger Haug shooting author's Whiscombe JW80 at bullfrogs that were laser ranged at 104 to 126 yards.



John Whiscombe displaying his JW65 with a Tasco Custom Shop 8-40X scope.

caliber barrel in order to shoot 10.5 grain Premiers at higher velocity, which should flatten my trajectory and help me knock down more field targets.

If you are in the market for a high-end hunting or field target rifle take a hard look at the Whiscombe rifles. Indeed, they are pricey, but I feel they are worth the price. When I compare a similar priced firearm to a Whiscombe and compare the quality and fit and finish, I get the distinct feeling that the firearm is over-priced and that the Whiscombe is actually a bargain. Better get your order in quickly, because the backlog for a Whiscombe is currently a little over a year.

TEST RESULTS/ Oehler 35P Chronograph/ about 6 inches from start screen

Whiscombe JW80 FB MKII

Pellet tested: .22 caliber 14.3 grain Crosman Premier

* Pellets lightly lubed with a 50% / 50% mixture of STP engine oil treatment and Hoppes Number 9 lubricating oil.

Velocity:

Hi	964	fps
Low	954	fps
ES	010	fps
SD	003	fps
Avg.	958	fps
Energy	29.14	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .41" (24X magnification)

75 yards outdoors: 1.07"

Soap penetration test: 10 yards

Premiers = 6.2 to 6.4 bars of Ivory soap

Trigger rating: (1= abysmal, 10 = perfect)

Stock trigger: 10

WHISCOMBE JW65 FB MKII

Manufacturer: John Whiscombe, Berkshire, England

Factory specifications

Type of power plant: Recoilless Dual spring-piston

Cocking method: Under-lever

Weight: 10 pounds

Barrel Length: 17", Interchangeable barrels

Velocity: 850 fps with .177 cal. 10.5 grain

Premiers; 790 fps with .20 cal. Premiers;

830 fps with .22 cal. Premiers

Cocking effort: (two strokes) 21 pounds and 31.5 pounds

TEST RESULTS/ Oehler 35P Chronograph/ about 6 inches from start screen

Whiscombe JW65 MKII

Pellet tested: .20 caliber 14.3 grain Crosman Premier

* Pellets lightly lubed with a 50% / 50% mixture of STP engine oil treatment and Hoppes Number 9 lubricating oil.

Velocity:

Hi	766	fps
Low	759	fps
ES	007	fps
SD	002	fps
Avg.	762	fps
Energy	18.44	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups' shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .39" (24X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 10

TEST RESULTS/**Whiscombe JW65 MKII**

Pellet tested: .177 caliber 10.5 grain Crosman Premier

* Pellets lightly lubed with a 50% / 50% mixture of STP engine oil treatment and Hoppes Number 9 lubricating oil.

Velocity:

Hi	853	fps
Low	845	fps
ES	008	fps
SD	002	fps
Avg.	848	fps
Energy	16.77	foot pounds

Average accuracy: compiled from four 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .36" (24X magnification)

John Whiscombe on his line of air rifles

Comparison of the JW Whiscombe models

"JW 50 — Smooth, easy to cock using two strokes 800-875 fps in .177 (7.9's). Mainly a United Kingdom gun for Field Target, can give 16 Ft. lb. in .22 caliber.

JW 65 — Still two strokes to cock, but stiffer. 1050 fps in .177 with 7.9 grain pellets, 850 fps in .177 with 10.5 grain pellets, 790 fps in .20 with 14.3 grain pellets, and 830 fps in .22 with 14.3 grain pellets. Nice to shoot especially in .177 with 7.9 grain Premiers, very flat trajectory and very accurate when set up properly. Good gun for U.S. Field Target or even hunting. If I could only have one gun and one barrel it would be a JW 65 in .177 shooting 7.9 grain pellets.

JW 80 — Three strokes to cock, a powerful raccoon basher. 1200 fps in .177 with 7.9 grain pellets, 1000 fps in .177 with 10.5 grain pellets, 890 fps in .20 with 14.3 grain pellets, and 950 fps in .22 with 14.3 grain pellets, and 840 fps in .25 with H&N Trophies. Best all around in .22 caliber, although very impressive in .177 with 7.9 grain pellets æ accurate and loud due to supersonic bang.

The lube I use for the pellets for these power levels is a 50/50 mix of Hoppes No. 9 lubricating oil and STP engine additive.

If only Crosman made a short .20 caliber at 11 to 11.5 grains — but they don't. This would give 1050 fps in the JW80. Much has been made in the U.K. about the .20 being the perfect compromise etc. etc. I don't agree. Well, not for a spring gun anyway; that favors large diameter lightweight pellets. The Crosman .20 is by far the best made and most accurate, but it is too heavy and even with its more domed head it does not approach the ballistic coefficient of the .22 until shooting at over 900 fps. Also, in my guns it leaves the muzzle with a 3 foot pound penalty to start with.

Pellets

a) Shape

There is no doubt that the best shape is still the round headed diabolo shape for velocities that air guns shoot at. These vary between long tailed and short tailed. (i.e. the 10.5 grain .177 Crosman Premier and the 7.9 grain .177 Premier) The long tail has perhaps more stability, due to drag, but has a lower ballistic coefficient and therefore more susceptible to wind.

b) Size

The pellets must have a head which grips the lands otherwise it could rattle down the bore, hit the choke at a slight angle and fly off-true. The skirt size is less critical.

c) Material

Crosman pellets are made from harder lead alloy (0.8% antimony) as opposed to the German and British type (0.4% antimony). This means that they are less liable to distortion, but lead up the rifling more.

Rifling twist

I think that twists of 1 in 16" to 18" are too fast for the modern velocities experienced in airguns. Diabolo pellets are drag-stabilized and only require

a moderate amount of spin to keep the ballistic coefficient reasonable. I have found that at moderate ranges (40 yards) the rate of twist has little effect with good pellets, but at ranges of 60 plus yards the slower twist barrels will shoot tighter groups. Also, slow twist barrels are more tolerant of pellets whose center of gravity is not in line with the center of rotation. At these extended ranges the pellet has slowed down considerably, but is still spinning very fast and is over-stabilized.

Choke

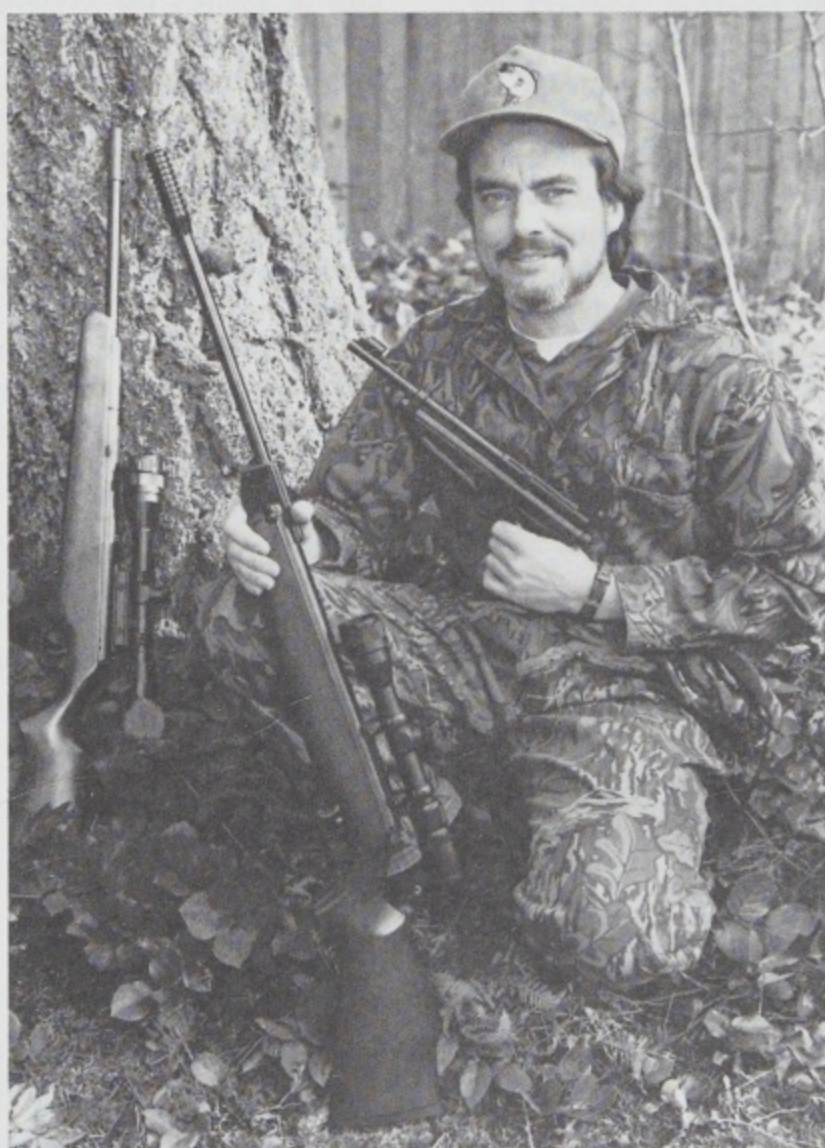
I use a minimum choke of less than 0.001 (1 thousandth of an inch). No more is needed and gives the pellet too much of a shock, plus leading up, if the choke is too tight. Ideally, a barrel should have a gradual taper from breech to muzzle, but these are expensive!

Barrels

I prefer very shallow rifling with rounded edged lands and grooves or, even better, polygonal rifling. This rifling will distort the pellets far less, and the actual periphery of the skirt edge is less than a heavily indented skirt. Alan Zasadny has found a marked difference in ballistic coefficients between different types of rifling. The heavily indented pellet has a greater surface area at the head and skirt, causing greater drag."

CHAPTER 8

Airgun Tests *Classic & Discontinued Guns*



Russ Foster displays two discontinued airguns – a Beeman R10 rifle and a Crosman SSP-250 pistol.

AIR ARMS TX200 SR (Semi-Recoiling) .177 Caliber

Manufacturer: Air Arms, East Sussex, England.

Factory specifications

Type of power plant: Spring-piston

Cocking method: Under-lever

Weight: 9 pounds 6 oz.

Overall Length: 42"

Walther Barrel: 14.75"

Energy: 12 foot pounds

Discontinued 1997.

Air Arms introduced the TX200 SR in 1993 as the regular TX200 was gaining in popularity. The SR version was presumably intended mainly for British Field Target competition, however it also found modest favor around many U.S. Field Target clubs as well. The stock on the SR version is even more conducive to Field Target shooting than the stock on the straight TX200, because it incorporates a wide flat palm rest just forward of the trigger guard. The SR version achieves its semi-recoiling behavior because the action, (with barrel and scope attached) rides on steel rails. When the shooter launches a pellet down the bore, the action merely rolls backwards inside the stock, and this isolates the shooter from most of the normally felt spring-piston movement.

The way the action rides upon the rails is known as a sledge recoil dampening system. The TX200 SR is by no means the only airgun to incorporate a sledge system. The ubiquitous

Feinwerkbau 150/300 series 10-meter target rifle and FWB model 65 pistol use essentially the same sledge system. Probably the most potent air rifle to use this system is the current production RWS model 54 side-cocking spring rifle.

The TX200 SR sledge system was designed around a 12 foot pound power plant. Remember 12 foot pounds of energy output is the British limit, unless you jumped through all the hoops paid the extra fees and have a British FAC permit. Many airguns intended for U.S. Field Target approach the recommended limit of 20 foot pounds, which means homegrown shooters may view the TX200 SR as a little on the anemic side.

Several years ago, I bought a used TX200 SR from local airgun dealer Jim Benson and have never regretted the purchase. Ken Reeves, who specializes in tuning the SR version, did a grand job on mine. When Ken performs an SR tune it includes a series of modifications that incorporate special locknuts to keep the tension consistent in the sledge system. As an aside, it was through Ken that I learned not to try to adjust these locknuts because they work essentially as installment-time-adjustable only, and any additional tweaking on them merely ruins their "locking" ability and then a new set of locknuts will be needed. Ken's TX200 SR tunes have earned an enviable reputation for transforming a somewhat capricious factory "Jekyll & Hyde" type of rifle into a stable shooter that maintains its accuracy. Ken also adjusted the trigger on mine to release



Author's Air Arms TX200 SR with a Bushnell Elite 8-32X scope and B-Square mounts

very crisply with a mere eight-ounce pull. My SR is considered "hot" because its power output is slightly over the British 12 foot pound limit as it consistently spits out 7.9 grain Premiers at an average velocity of 842 fps. For field target shooting, I mounted a superb Bausch & Lomb Elite 8-32X-40mm scope.

Rick Stoutenburg captured the 1997 Spring-Division Field Target World Championship with a tuned TX200 SR, and afterwards it became quite the rage. A tuned TX200 SR is highly regarded by many spring-gun aficionados because of its superb accuracy, while being less hold (or grip) sensitive than most other spring rifles. My TX200 SR appears to be my second most accurate field target rifle æ right behind my Whiscombe JW-65. The TX200 SR was discontinued in 1997, probably because demand didn't justify the higher production costs over the straight TX200 version.

TEST RESULTS/ Oehler 35P Chronograph/ about 6" inches from start screen

TX200 SR (tuned by Ken Reeves)

Pellet tested: .177 caliber 7.9 grain Crosman Premier

Velocity:

Hi	849	fps
Low	835	fps
ES	014	fps
SD	004	fps
Avg.	842	fps
Energy	12.43	foot pounds

Average accuracy: compiled from four, 5-shot groups.

All groups shot from an Ultimate Tripod built

by McFadden Machine Co., Inc.

40 yards indoor: .44" (24X magnification)

Trigger rating: (1 = abysmal, 10 = perfect)

As tuned: 8+

Factory trigger: 6

Models from Beeman Precision Airguns

BEEMAN R8 .177 & .22 (tuned by Ken Reeves)

Manufacturer: Weihrauch, Hans-Hermann, Mellrichstadt Germany.

Factory specifications

Type of power plant: Spring-piston

Cocking method: Break-barrel

Weight: 7.2 pounds

Overall Length: 43"

Velocity: .177 - 720 fps (.22 - 550 fps)

Cocking effort: 24 lbs.

Discontinued 1997.

The discontinued Beeman R8 is sometimes called the "big brother" to Beeman's popular R7. I always intended to purchase a Beeman R8 when it was still in production, but somehow I didn't get around to it, and before I realized it the R8 was unfortunately discontinued. My search was on to locate a used R8 and with assistance from Paul Anderson (of B&B Supply in Minneapolis, Minnesota) I tracked down a pair of used Beeman R8's. My special find of R8's just happened to be a matching set in .177 and .22 caliber.

The .22 caliber version is relatively rare, and I never really gave much thought to ever owning one. I knew the .22 caliber R8 was a rare bird,



Author's .22 caliber Beeman R8 with a Simmons Pro Air 4-12X scope

because I recently discovered an old 1993 issue of Beeman's Shooters News from my archives that listed a special deal on a limited importation of fifty .22 caliber R8's. Wow, suddenly I had a chance to own not only a standard R8 in .177, but also an uncommon version in .22 caliber! The price was reasonable and it seemed like an offer too good to pass up, so I bought the two air rifles from B & B Supply, sight unseen, over the phone. Because these air rifles had reportedly been idle for several years, I had the pair sent straight off to Ken Reeves for tune-ups.

I thought my .177 version would work out great as a beginner's field target rifle, and accordingly, I installed a Simmons Pro Air 6-18X scope with B-Square mounts. My ten-year old son, Alan, used this rig during a Field Target match and found it to be easy to cock and a joy to shoot. My .22 version was matched up to a 4-12X Simmons Pro Air scope, and this combination has also worked out well.

I figured I would be shooting the .177 version the most because of the lower velocity output and loopy trajectory from the .22 version. But as it turned out, my .22 caliber R8 became my preferred short-range rat killer. After some experimentation, twenty-two caliber Beeman Silver Bear pellets became my pellet of choice for shooting rats out to ranges of around 20-25 yards. I frequently shoot rats in the vicinity of barns and storage sheds and to lessen the chance of structural damage from a stray pellet or from a pellet that has already zipped through a rat, I like to shoot pellets with quick expansion and limited penetration, like the Silver Bear. My .22 caliber R8 and the Beeman Silver Bear pellet are a good combo for short-range rat shooting. My .177 caliber version, for some unknown reason, does not kill rats as decisively as the .22 version even with Silver Bear pellets; for my guess, it's because the .22 caliber drills a little larger wound channel, which introduces a tad more shock effect into the rat.

The R8, being slightly more powerful and slightly heavier than the R7, appealed to those shooters who appreciated the extra velocity; but at the same time wished to retain the mild firing behavior and easy cocking features of its smaller sibling. I actually prefer the little extra oomph the R8 puts out over the R7 and was quite surprised that it was discontinued in 1997. The R8 has such a smooth shooting cycle and is so pleasant to shoot that I usually plink at a few targets with one of my versions at least briefly every day of the year.

TEST RESULTS/ Oehler 35P Chronograph/ about 6" inches from start screen

Beeman R8 .177 (tuned by Ken Reeves)

Pellet tested: .177 caliber 7.9 grain Crosman

Premier

Velocity:

Hi	697	fps
Low	681	fps
ES	016	fps
SD	006	fps
Avg.	689	fps
Energy	8.33	foot pounds

Average accuracy: compiled from four, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .57" (18X magnification)

Soap penetration test: 10 yards

7.9 gr. Premiers = 3 bars of Ivory soap

Cocking effort: 22-23 pounds

Trigger rating: (1 = abysmal, 10 = perfect)

As tuned: 8+

TEST RESULTS/

Beeman R8 .177 (tuned by Ken Reeves)

Pellet tested: .177 caliber 8.8 grain Beeman

Crow Magnum

Velocity:

Hi	667	fps
Low	656	fps
ES	011	fps
SD	002	fps
Avg.	662	fps
Energy	8.56	foot pounds

Average accuracy: compiled from four, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .79" (18X magnification)

Soap penetration test: 10 yards

Crow Magnum = .95 bars of Ivory soap

Cocking effort: 22-23 pounds

TEST RESULTS/

Beeman R8 .22 (tuned by Ken Reeves)

Pellet tested: .22 caliber 14.3 grain Crosman

Premier

Velocity:

Hi	541	fps
Low	528	fps
ES	013	fps
SD	004	fps
Avg.	536	fps
Energy	9.12	foot pounds



Author's .20 caliber Beeman R10 with a Bushnell Trophy 4-15X scope

Average accuracy: compiled from four, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoor: .60" (12X magnification)

Soap penetration test: 10 yards

14.3 Premiers = 1.25 bars of Ivory soap

Cocking effort: 22-23 pounds

Trigger rating: (1 = abysmal, 10 = perfect)

As tuned: 9

TEST RESULTS/

Beeman R8 .22 (tuned by Ken Reeves)

Pellet tested: .22 caliber 12.65 grain Beeman Silver Bear

Velocity:

Hi	582	fps
Low	572	fps
ES	010	fps
SD	002	fps
Avg.	577	fps
Energy	9.35	foot pounds

Average accuracy: compiled from four, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .69" (12X magnification)

Soap penetration test: 10 yards

Silver Bear = .95 bars of Ivory soap

Cocking effort: 22-23 pounds

BEEMAN R10 .20 Caliber

Manufacturer: Weihrauch, Hans-Hermann, Mellrichstadt, Germany.

Factory specifications

Type of power plant: Spring-piston

Cocking method: Break-barrel

Weight: 7.9 pounds

Overall Length: 45.8"

Velocity: 935-1000 fps (.177)

Cocking effort: 25 lbs. (Beeman Precision

Airgun Guide Edition 19, lists the R10 at 34 lbs. of required cocking effort).

Discontinued 1995.

The Beeman R10 was conceived as a smaller, lighter version of the Beeman R1 and some shooters called it the son of the R1. As compared to the R1, the R10's power output routinely fell shy by some 2 to 4 foot pounds of energy. The Beeman folks always maintained that the R10 complemented, rather than competed with, the heavier R1. Because of the way it was engineered and its internal configuration, the R10 does not respond appreciably with attempts to increase its velocity through aftermarket tunes or rebuilds. Beeman started phasing out their R10 in 1995 as the improved R9 moved up to the forefront to take its place.

I latched onto a .20 caliber R10, while it was being pushed as Beeman's hot new spring-gun. I shot the rifle extensively the first year then shipped it back to Beeman for a Super Tune. The Super Tune certainly helped smooth the shooting cycle, and afterwards I wondered why I waited so long to have it done. Through the years I used my R10 to eliminate several hundred troublesome pests, many of which were shot at surprisingly long distances (i.e. over 50 yards).

My Cryogenic Experiment Deep Cryogenic Tempering (Cryo Processing)

Back around 1995 this process started becoming popular with firearm enthusiasts everywhere, particularly the accuracy oriented, and it is still gaining followers. Cryogenic research has brought about new cryogenic tempering machines. New applications that can benefit from this process seem to be discovered everyday, and among these, include rifle barrels, tools, drill bits, bearings, racing engines, knives, and even musical instruments. So I thought why not try the process on a airgun mainspring?

Deep cryogenic tempering and stabilizing is a completely computer controlled process and accurate to 1/10th of 1°f. The selected object is slowly cooled from room temperature down to -300°f at a rate of less than one degree per minute. The object is then held at this temperature for 24 hours and then returned to room temperature. This "deep-freeze" procedure is a dry process, where no liquid comes in contact with the rifle barrels. The object is then placed in tempering ovens to +300°f. This entire process takes upwards of 48 hours to complete, to eliminate any chance of thermal shock.

You may be asking how this process might benefit a mainspring? A steel firearm barrel may receive the most benefit, and that is one reason target shooters are generally high on this process. However, I have never heard of anybody experimenting with cryogenics and airgun mainsprings, so I thought I would give it a try.

Deep cryogenic stress relief is especially effective for decreasing residual stresses and is also said to increase the durability of steel. This process is a one-time permanent, irreversible molecular change. Other advantages may include:

- Increased resistance to abrasive wear.
- Transforms most retained softer austenite to harder martensite.
- Forms microfine carbide fillers to enhance carbide structures.
- Decreases brittleness.
- Increases tensile strength, toughness and stability.
- Relaxes internal stresses.

I had recently chronographed my old R10, and it seemed as if the velocity was a little on the low side. My R10 had been Super Tuned by Beeman

over a decade earlier, so it was possible that the mainspring could have been a little tired from the thousands of shots that were fired over the years.

After chronographing and testing my factory R10, I had noted Portland, Oregon airgun dealer and tuner Darrell Schenk install a regular Maccari mainspring, along with a new synthetic piston seal. Re-testing was on my agenda and after recording my data Darrell removed the spring (which I saved) and installed another new Maccari test spring. Let it be known that my latest R10 Maccari spring is not a stock Maccari spring; Cryo One of Puyallup, Washington cryogenically treated it.

My theory was based around the fact that airgun mainsprings are severely stressed when cocked, and a cryogenically treated spring would be able to withstand this stress better over the life of an airgun. The treated Maccari spring showed a slight increase in velocity; but this could have occurred from the result of other variables. The velocity output was more consistent, and my R10 also showed a lower standard deviation. Of course, it is way too early to predict any kind of longevity increase or decrease with my new treated spring. Testing one cryogenic mainspring probably means very little, as one sample does not necessary prove anything. I would probably need to test perhaps 100 cryogenically treated mainsprings against normal springs to come up with any kind of firm conclusions. Results of my testing follow next.

TEST RESULTS/ Oehler 35P Chronograph/ about 6" inches from start screen

Beeman R10 with a new Maccari spring

Pellet tested: .20. caliber 14.3 grain Crosman

Premier

Velocity:

Hi	670	fps
Low	644	fps
ES	026	fps
SD	009	fps
Avg.	652	fps
Energy	13.33	foot pounds

Average accuracy: compiled from four, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .66" (12X magnification)

Cocking effort: 29-30 pounds

Trigger rating: (1 = abysmal, 10 = perfect)

As tuned: 8+

Factory trigger: 8-

Beeman R10 with a new Maccari spring

Pellet tested: .20. caliber 12.2 grain Beeman
FTS

Velocity:

Hi	772	fps
Low	758	fps
ES	014	fps
SD	003	fps
Avg.	765	fps
Energy	15.85	foot pounds

Average accuracy: compiled from four, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .84" (12X magnification)

Cocking effort: 29-30 pounds

Beeman R10 with a new cryogenically processed Maccari spring

Pellet tested: .20 caliber 14.3 grain Crosman
Premier

Velocity:

Hi	679	fps
Low	664	fps
ES	015	fps
SD	005	fps
Avg.	671	fps
Energy	14.30	foot pounds

Average accuracy: compiled from four, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .64" (12X magnification)

Cocking effort: 29-30 pounds

Beeman R10 with a new cryogenically processed Maccari spring

Pellet tested: .20 caliber 12.2 grain Beeman
FTS

Velocity:

Hi	785	fps
Low	771	fps
ES	014	fps
SD	002	fps
Avg.	777	fps
Energy	16.35	foot pounds

Average accuracy: compiled from four, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .85" (12X magnification)

Cocking effort: 29-30 pounds

Beeman .20 R-10 (Beeman Super Tuned 10 years earlier)

Pellet tested: .20 caliber 14.3 grain Crosman
Premier

Velocity:

Hi	659	fps
Low	619	fps
ES	040	fps
SD	010	fps
Avg.	640	fps
Energy	13.0	foot pounds

Average accuracy: compiled from four, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .70" (12X magnification)

BEEMAN / FEINWERKBAU 124 .177 Caliber

Manufacturer: Feinwerkbau Westinger & Altenburger GmbH & Co. Oberndorf, Germany.

Factory specifications

Type of power plant: Spring-piston

Cocking method: break barrel

Weight: 7.2 pounds

Overall Length: 43.5"

Velocity: 780-830 fps

Discontinued 1989.

The FWB 124 is highly regarded as a genuine classic magnum air rifle, easy to cock and accurate. The FWB 124 in .177 caliber and its twin model 127 in .22 caliber represented the upper class as high power sporters easily capable of taking small game. The FWB 124/127 series was conceived in 1974 as Feinwerkbau's first sporter series air rifles. Feinwerkbau was, of course, a well-known name with their world-class ten meter target rifles, so when the 124 finally hit the market it made a deep impression. Air Rifle Headquarters in West Virginia pushed the model 124 and offered many aftermarket upgrades including power boosts. The 124 was first advertised as having a velocity output of 750 fps, but with power upgrades it was listed all the way up to 830 fps with light pellets. The amazing aspect of the 124 is that it cocks with about 18-20 pounds of effort, whereas a rifle like the Beeman R1 is listed to cock with 34 pounds of effort. The FWB 124/127 was the rage in a sporter air rifle, up until the Beeman/Weihrauch R1 was launched.

I bought my first FWB 124 during the late



Author's .177 caliber Beeman/Feinwerkbau model 124



Author shooting his FWB model 124
— Photo by Alan Hanson

1970's from Air Rifle Headquarters, and it remained in my stable until I loaned it to an acquaintance whom I never heard from since. I never forgot how much I enjoyed shooting my 124, and when I found one on Darrell Schenk's table during a gun show I quickly swept it up. Mine probably has a tired spring, which I surmised from the lower than normal velocity levels that were flashing before me on my chronograph. Mine is pushing 7.9 grain Premiers to an average velocity of 730 fps, which is at least 30-40 fps on the low side. I installed a Simmons 6-18X Pro Air scope with a B-Square one piece mount.

**TEST RESULTS/ Oehler 35P Chronograph/
about 6" inches from start screen
Factory FWB 124 (tired spring?)**

Pellet tested: .177 caliber 7.9 grain Crosman Premier

Velocity:

Hi	742	fps
Low	718	fps
ES	024	fps
SD	007	fps
Avg.	730	fps
Energy	9.34	foot pounds

Average accuracy: compiled from four, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .61" (18X magnification)

Cocking effort: 21 pounds

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 6+

BEEMAN / FEINWERKBAU 300S

Manufacturer: Feinwerkbau Westinger & Altenburger GmbH & Co. Oberndorf, Germany.

Factory specifications:

Type of power plant: Recoilless spring-piston
 Cocking method: Side cocking
 Weight: 10.8 pounds with sleeve
 Overall Length: 43.3"
 Velocity: 640 fps
 Cocking effort: 9 pounds
 Discontinued 2001.

Beeman just recently discontinued the FWB 300S, most likely from consumer sales swinging towards more modern single-pump pneumatic and pre-charged pneumatic models. In 1969 Feinwerkbau introduced the model 300, and in 1972 the design was upgraded to the model 300S. As with the TX200 SR, the 300S incorporates a sliding "sledge" system that for the most part "masks" the recoil that is normally felt by the shooter. When you pull the trigger on a 300S, a sear is simultaneously activated which allows the entire receiver to slide backwards negating the gun's spring-piston movement. The shooter only feels a very slight sensation of gun movement. The 300S is accurate and fun to shoot; what more could you ask for?

The trigger is another great feature of this rifle, as it can be adjusted for both first and second stage pulls. The overall pull is adjustable from 3.5 ounces to 17.7 ounces; it can be also adjusted fore and aft and canted from left to right.

The 300S is the easiest to cock spring-piston ten-meter rifle that I am aware of — only 9 pounds of effort is required. I chose my 300S to compete in the piston class of BRV competition. When I am able to read the wind flags accurately, I do well with my 300S, however, for some

strange reason, I rarely read the flags well during competition and regularly do my best shooting during practice.

TEST RESULTS/ Oehler 35P Chronograph/ about 6" inches from start screen**Feinwerkbau 300S**

Pellet tested: .177 caliber 8.09 grain Beeman

H&N Match

Velocity:

Hi	582	fps
Low	577	fps
ES	005	fps
SD	001	fps
Avg.	579	fps
Energy	6.02	foot pounds

Average accuracy: compiled from four, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

20 yards indoors: .22" (18X magnification)

Cocking effort: 9 pounds (factory spec)

Trigger rating: (1= abysmal, 10 = perfect)

Stock trigger: 10

BEEMAN / WEIHRAUCH HW55MM

Manufacturer: Weihrauch, Hans-Hermann, Mellrichstadt, Germany.

Factory specifications

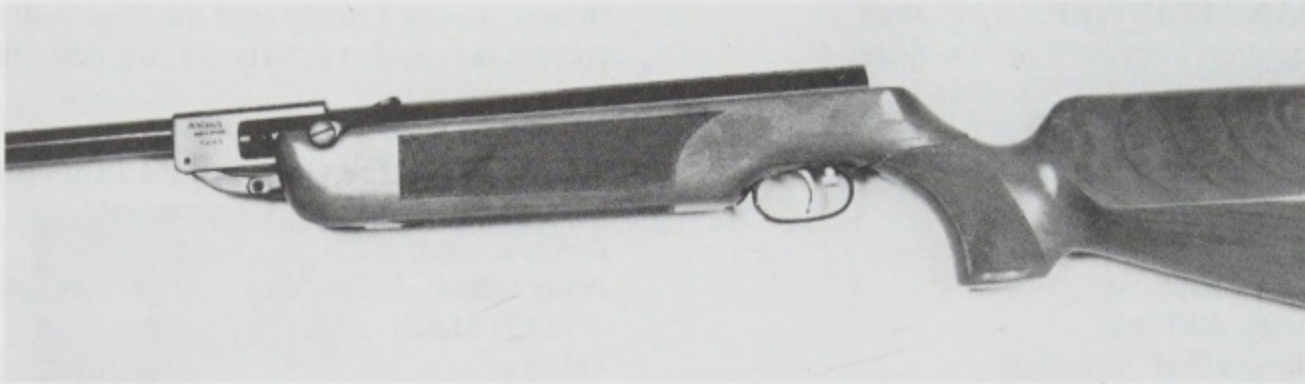
Type of power plant: Spring-piston
 Cocking method: Locking break-barrel
 Weight: 7.8 pounds
 Overall Length: 43.7"
 Velocity: 660-700 fps
 Cocking effort: 18 pounds

The HW55 is considered by many to be the consummate recoiling spring match rifle. The HW55's that I have shot were all well tuned specimens and were the mildest recoiling spring guns



A Beeman / Feinwerkbau 300S

— Photo courtesy of Beeman Precision Airguns.



Author's Beeman/Weihrauch HW55MM air rifle

that I have ever had the pleasure of shooting. The next step-up would be a true recoilless model such as a FWB 300S. In fact, when I shoot a finely tuned HW55 with an ultra-smooth firing cycle it reminds me of the recoilless FWB 300S, because the shooting esthetics are that similar.

Beeman has not imported this model since about 1992, so essentially this model is considered discontinued if you live in the U.S. However, the Weihrauch factory is still producing the HW55 in limited editions for the European market. Probably the last hurrah for the model 55 happened in 1968 when a competitor shooting a HW55 won the European 10-meter Championship over many newer recoilless guns.

I found a nice 55MM from Minnesota airgun dealer Ingvar Alm. It had been sitting idle for years so I had it tuned by Ken Reeves. Unfortunately, upon return shipping the stock was broken in two pieces. With no replacement stock in sight, I decided to glue it together so I could test the gun for velocity. However, I decided to forgo my accuracy testing, as it would have been futile considering that the glued piece of wood is unstable and is prone to shifting. I will continue with my search for a suitable replacement stock.

TEST RESULTS/ Oehler 35P Chronograph/ about 6" inches from start screen

Beeman HW55 (tuned by Ken Reeves)

Pellet tested: .177 caliber 8.09 grain Beeman

H&N Match

Velocity:

Hi	599	fps
Low	581	fps
ES	018	fps
SD	004	fps
Avg.	588	fps
Energy	6.22	foot pounds

Cocking effort: 19-20 pounds

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 9

CROSMAN MODEL 160

DUAL CO₂ .22 Caliber

Manufacturer: Crosman Air Guns, East Bloomfield, NY.

Factory specifications: .22 caliber

Type of power plant: Gas - Two 12 gram CO₂ powerlets

Cocking method: Bolt action

Weight: 5 pounds 10 oz.

Overall Length: 40"

Velocity: 600 fps average muzzle velocity

Barrel length: 20.5" (Model 167 designates the .177 caliber version).

The Crosman model 160 is highly regarded in the U.S. as a classic air rifle, while many call it the quintessential American CO₂ gun. Production of the model 160 spanned 16 years from 1955 to 1971. Originally designed for NRA marksmanship training at 25 to 30 feet. At first glance, the model 160 series looks very much like a bolt action .22 rimfire rifle. When rimfire shooters were lured into inspection range they also discovered that it loaded and cocked like a "real" single-shot .22 rifle. This visual tease by Crosman was not by accident, and it surely helped to promote its usefulness and value.

Dave Gunter, a highly recommended vintage airgun tuner and airgun restorer, told me that Crosman 160 barrels vary widely in quality. Dave figures he has examined over one hundred model 160 barrels, and reiterates that accuracy has varied the full gamut from dismal to mediocre to excellent, depending upon the quality of the original barrel.

I use my model 160's mainly as short range rat busters. I have also used my 160's on ground squirrels, during afternoon shoots when I figured



Author's Crosman model 160 — customized by Dave Gunter. A Simmons Pro Air 4-12X scope in B-Square mounts graces this rig.



Author's large bulk supply of Crosman CO₂ cartridges

the temperature had stabilized. Remember this is CO₂ gun and as such it is temperature sensitive, which means it is prone to change zero if the ambient temperature rises or drops more than about a five to eight degree range.

I had Dave Gunter assemble a customized 160 with a new .22 caliber Career barrel. This rifle also incorporates Dave's special valves and fine tuning, which increases the velocity and consistency. I thought a comparison between two factory 160's and Dave's tuned model would make

an interesting test. The accuracy I obtained from my new Career barrel is amazing, as it handily outperformed my factory guns, and I highly recommend Dave Gunter's work. However, remember that Dave only occasionally has room for custom work on his slate, because his normal day to day vintage airgun repairs take up most of his time.

(My factory test specimens were restored with new blueing and the triggers were tuned, but otherwise they are standard factory issue.)

TEST RESULTS/ Oehler 35P Chronograph/ about 6" inches from start screen

Factory Crosman 160 - Number One

Pellet tested: .22 caliber 14.3 grain Crosman
Premier

Velocity: 70°f	(15 shot string)	(20 shot string)
Hi	620 fps	622 fps
Low	594 fps	561 fps
ES	026 fps	061 fps
SD	006 fps	017 fps
Avg.	606 fps	588 fps
Energy	11.66 ft. lbs.	10.98 ft. lbs.

Average accuracy: compiled from three, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .93" (12X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

Factory: 6

As tuned: 7+

TEST RESULTS/

Factory Crosman 160 - Number Two

Pellet tested: .22 caliber 14.3 grain Crosman
Premier

Velocity: 70°f	(15 shot string)	(20 shot string)
Hi	604 fps	602 fps
Low	566 fps	535 fps
ES	038 fps	067 fps
SD	010 fps	018 fps
Avg.	592 fps	573 fps
Energy	11.13 ft. lbs.	10.42 ft. lbs.

Average accuracy: compiled from three, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: 1.19" (12X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 7

TEST RESULTS/

Dave Gunter - Custom Career barreled Crosman 160

Pellet tested: .22 caliber 14.3 grain Crosman
Premier

Velocity: (20 shot strings)	72°f	80°f
Hi	715 fps	744 fps
Low	684 fps	716 fps
ES	031 fps	028 fps
SD	008 fps	007 fps
Avg.	694 fps	727 fps
Energy	15.29 ft. lbs.	16.78 ft. lbs.

Average accuracy: compiled from four, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .58" (12X magnification, at 72°f)

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 8+

Heavy -versus- Lite CO₂ test

Urged on by Dave Gunter, I started weighing and segregating 12 gram CO₂ cartridges to determine if the weight of a cartridge affects velocity or consistency. Since I already had a large supply of over 700 Crosman cartridges, it was relatively easy to determine an average weight. My Denver electronic scale was warmed up and ready to go, and soon I determined that a weight of 650 grains and under appeared to be "lite" cartridges, while cartridges over 677 grains were "heavies". Using my Gunter modified Crosman 160 as my test rifle, I commenced to shoot and exhaust three batches of "heavy" cartridges and three batches of "lite" cartridges over my Oehler. Waiting approximately 25 seconds between shots and chronographing 20 shots per batch of cartridges, differences between the batches were clearly revealed by the Oehler and follow next. Velocity after 20 shots fell rapidly and after 29 or 30 shots the CO₂ cartridges were completely exhausted.

TEST RESULTS/ Heavy -Vs- Lite CO₂ cartridges approximately 25 seconds between shots Dave Gunter Custom Career barreled, Crosman 160

Pellet tested: .22 caliber 14.3 grain Crosman
Premier

Velocity: 68°f (60 shot string average, 20 shots per pair of cartridges)

	"Lites"	"Heavies"
Hi	693 fps	694 fps
Low	650 fps	676 fps
ES	043 fps	018 fps
SD	016 fps	005 fps
Avg.	681 fps	685 fps
Energy	14.72 ft. lbs.	14.90 ft. lbs.

Average accuracy: compiled from four, 5-shot groups.

Using "heavy" segregated CO₂ cartridges. All groups shot from an Ultimate Tripod.

40 yards indoors: .54" (12X magnification)

Average velocity: 685 fps



Author's Crosman model 262 CO₂ powered air rifle. The author eventually mounted a Weaver 2.5-7X Rimfire scope for increased accuracy potential.

CROSMAN 262

CO₂ .177 Caliber

Manufacturer: Crosman Air Guns, East Bloomfield, NY.

Factory specifications

Type of power plant: CO₂ gas

Cocking method: bolt action

Weight: 5 pounds 10 oz.

Overall Length: 39¼"

Velocity: 600 fps

During the mid 1980's, Crosman brought out the lightweight model 262 CO₂ rifle as a general purpose beginner's pellet rifle. It was also available in a youth version with a shorter and lighter stock. It has enough power to kill mice and other small pests and seems accurate enough for use as a training rifle for youngsters.

TEST RESULTS/ Oehler 35P Chronograph/ about 6" inches from start screen

Crosman 262

Pellet tested: .177 caliber 7.9 grain Crosman Premier

Velocity: 68°f (15 shot string)

Hi	602	fps
Low	580	fps
ES	022	fps
SD	006	fps
Avg.	594	fps
Energy	6.19	foot pounds

No scope was installed, so I decided to forgo my normal accuracy tests. Using the factory open sights I could easily keep five 7.9 gr. Premiers inside a 1" circle at 10 yards.

CROSMAN 99 .22 Caliber

CO₂ Lever action repeater

Manufacturer: Crosman Air Guns, East Bloomfield, NY.

Factory specifications

Type of power plant: gas, one CO₂ cartridge

Cocking method: lever action

Weight: 5 pounds, 10 oz.

Overall Length: 40"

Velocity: High power 500 fps, Low power 375 fps with 14.33 grain pellets

Discontinued 1970.

The Crosman model 99 is a basic lever action repeater that uses a non-removable spring loaded magazine. Mine feeds reliably with flat headed target pellets, but becomes erratic in feeding with other types of ammo. Crosman produced the model 99 for only five years from 1965 to 1970. Mine doesn't get shot that often anymore, but three or four times a year I take my 99 out and shoot it just enough to feel nostalgic, then, when its time to go back to being forty something again, I oil it and carefully put it back in the gun-vault.

**TEST RESULTS/ Oehler 35P Chronograph/
about 6" inches from start screen**

Crosman 99 .22 Caliber

Pellet tested: .22 caliber 14.3 grain Crosman

Copperhead Wadcutters

Velocity: 74°f (15 shot string)

Hi 528 fps

Low 502 fps

ES 026 fps

SD 014 fps

Avg. 516 fps

Energy 8.45 foot pounds

Average accuracy: compiled from three, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

10 yards indoors: .40" open sights

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 6

CROSMAN SSP-250

CO₂ Pistol .20 caliber barrel tested

Manufacturer: Crosman Air Guns, East

Bloomfield, NY.

Factory specifications

Type of power plant: gas, one CO₂ cartridge

Weight: 3 pounds, 1 oz.

Overall Length: 14"

Velocity: (.177) low power 525 fps high power 560 fps

Interchangeable .20 and .22 caliber barrels.

In 1989 Crosman launched its SSP (Silhouette Sport Pistol) 250 single shot CO₂ powered pistol. I bought mine new and almost immediately switched to a .20 caliber barrel, because at the time I was high on that caliber. I used my SSP effectively to take out a few rats and close-range ground squirrels, plus a few not so bright magpies fell prey to my pistol. Summer time heat combined with hollow point pellets made my pistol appear to be more deadly than I first believed possible.

By 1997 the SSP 250 was history, although it remains a favorite pistol with both my sons, Alan and Jason. Using a variety of pellets indoors, I



Author's .22 caliber Crosman model 99 CO₂ powered lever action repeater



Steve Doney shooting author's Crosman model 99



Author's Crosman SSP-250 CO₂ powered pistol

am able to keep five shots inside an inch at 10 yards.

**TEST RESULTS/ Oehler 35P Chronograph/
about 6" inches from start screen**

.20 Caliber Crosman SSP-250 C02

Pellet tested: .20 caliber 12.2 grain Beeman FTS

Velocity: 77°f Hi power (15 shot string)

Hi	491	fps
Low	458	fps
ES	033	fps
SD	008	fps
Avg.	471	fps
Energy	6.01	foot pounds

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 6

PARK RH93 .177 Caliber

Manufacturer: Park Rifle Co. Ltd. Kent, England

Factory specifications:

Type of power plant: Recoilless spring-piston

Cocking method: Under lever, bolt action

Weight: 9 pounds

Overall Length: 37"

Energy: 12 foot pounds

Discontinued about 1999.

The Park RH93 (and its near twin, model

RH91) was designed for British Field Target with the corresponding 12 foot pound power output limit. From what I hear, they rarely even make it to 12 foot pounds and normally put out around 10 or 11 foot pounds. Mine is a sub ten foot pound rifle, however its saving grace lies in its accuracy.

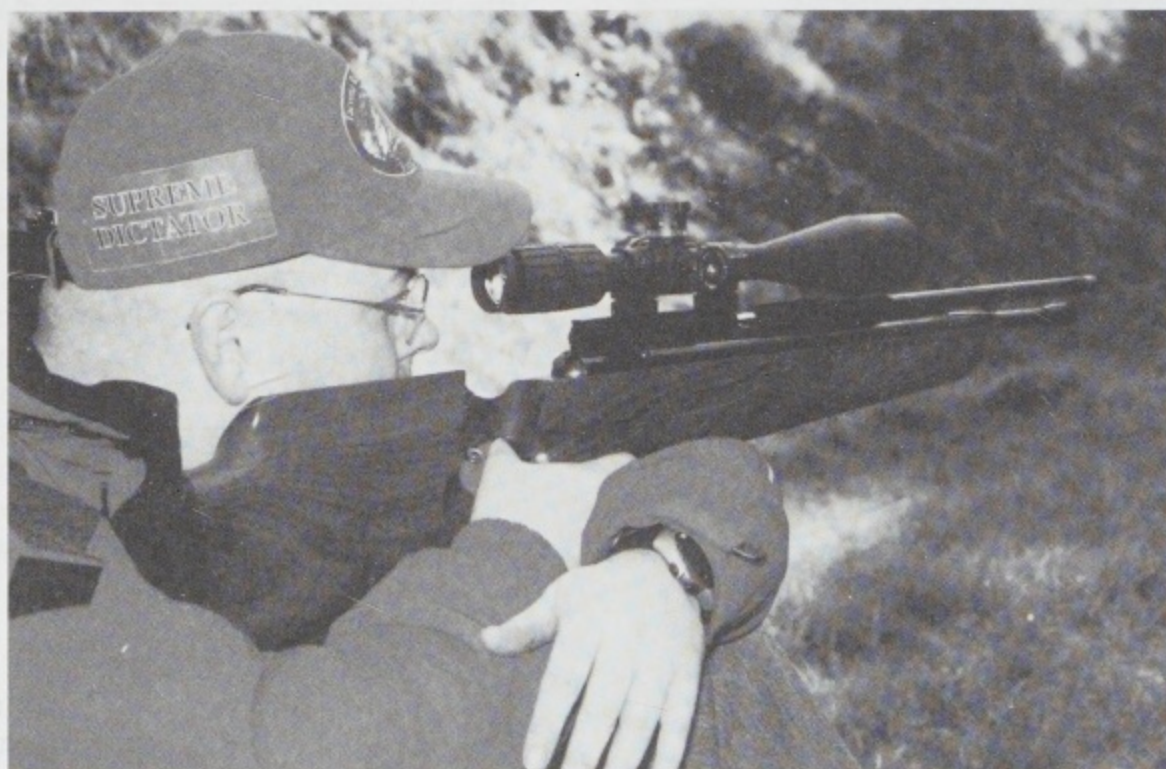
Firing behavior is recoilless and it is easy to stay focused on a field target, even with a high magnification scope. It is hard to put into words, but it has a slight twang sound to its discharge, otherwise the shooter has full concentration.

The Park rifle achieves its recoilless behavior from two converging pistons of unequal weight, which are powered by springs of different strength and different travel lengths. Also uncommon is the method used to cock the model RH93. The underlever mechanism is attached to a chain that pulls apart the pistons, and this chain looks suspiciously like a regular bicycle chain. It may appear to be rather complicated but the recoilless system works well, despite its imaginative engineering.

As a dedicated field target rifle, it seems to shoot rather well, however, I have reservations about its sub-ten foot pounds of energy reliably knocking down distant targets. My ten-year old son, Alan, has taken a liking to my Park and is currently using it for field target competition. The stock's length of pull is actually too long for



Author's Park RH93 recoilless air rifle with a BSA Platinum 6-26X scope and BKL scope rings.



Kyle McCormack shooting the Park RH 93 during a Field Target match.

Alan, but he is adamant that he can shoot it accurately. I installed a new side-wheel focusing BSA Platinum 6-26X-52mm scope on it that appears to be holding up fine for the task.

TEST RESULTS/ Oehler 35P Chronograph/ about 6" inches from start screen

Park RH93 Recoilless

Pellet tested: .177 caliber 7.9 grain Crosman

Premier

Velocity:

Hi	760	fps
Low	745	fps
ES	015	fps
SD	004	fps
Avg.	752	fps
Energy	9.92	foot pounds

Average accuracy: compiled from four, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .47" (24X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

As tuned: 9

Sportsman Deluxe QB 77

.177 DUAL CO₂

Manufacturer: Shanghai Airgun Company, Shanghai, China.

Factory specifications: .177 caliber

Type of power plant: Gas - Two 12 gram CO₂ cartridges.

Cocking method: Bolt action

Weight: 5.75 pounds

Overall Length: 40"

Velocity: 750 fps average muzzle velocity @ 60°f to 80°f.

Barrel length: 20.5"

The QB 77/22 series was essentially a reverse engineered Crosman 160/167. The driving force behind the QB series was Henry Harn and Tim McMurray. Mr. Tim McMurray is a third generation airgun aficionado, technician and owner of MAC-1 Airguns in Gardena, California. Mr. Harn, an American-trained Chinese engineer, was working in the Southern California area when he met Mr. McMurray, and this meeting of the "minds" and subsequent brainstorming between the two eventually led to the production of the QB series.

Mr. Harn had ties to the Shanghai Airgun factory, which later became the factory where they produced the QB series. Tim McMurray had previously perfected many "custom" Crosman model 160's, which incorporated his modifications and became the prototype that the Shanghai factory used to reverse engineer the "new" gas gun. By 1992 the .177 caliber QB77 was in full production, and a year later the QB22 (.22 caliber, of course) was also in production.

Just as with the Crosman 160, the QB series are powered by two 12-gram CO₂ cartridges (or bulk filled by a special adapter). To load a QB series gun you must first engage the safety and open the bolt. Next, the piercing cap is removed and two CO₂ cartridges are inserted back to back into the compression tube. After the piercing cap is hand tightened, the cap is given a quick quarter-turn counterclockwise twist to pierce the front



Author's .177 caliber Deluxe QB 77 CO₂ powered air rifle with a Beeman 2-7X scope.

cartridge. Closing the action and dry firing the rifle in a safe direction pierces the rear gas cartridge.

My personal model QB77 shot well, but had a rather hard trigger pull, which I remedied by taking the stock off and adjusting the trigger weight adjustment. Now the trigger breaks on my gage at just under three pounds, which helped immensely on the target range.

TEST RESULTS/ Oehler 35P Chronograph/ about 6" inches from start screen

QB 77 .177

Pellet tested: .177 caliber 7.9 grain Crosman Premier

Velocity: 68°f (15 shot string)

Hi	688	fps
Low	649	fps
ES	029	fps
SD	008	fps
Avg.	665	fps
Energy	7.75	foot pounds

Average accuracy: compiled from three, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

40 yards indoors: .65" (7X magnification)

Trigger rating: (1= abysmal, 10 = perfect)

Factory trigger: 4

As tuned: 7

RWS 75S T01

Manufacturer: Meyer & Grammelspacher (Dianawerk) Rastatt, Germany.

Factory specifications

Type of power plant: Recoilless Dual spring-piston

Cocking method: Side cocking

Weight: 11 pounds

Overall Length: 43"

Velocity: 580 fps

Cocking effort: 16 pounds

Discontinued 1990.

The RWS 75S T01 uses the famed Giss Contra principal of recoil suppression. The Giss Contra system employs two pistons that travel in opposite directions once the trigger sear is released. To cancel all recoil the two pistons must operate in unison, which is regulated by two small pinion gears. Of course, only one piston provides power to propel the pellet; the other is merely a "dummy" piston of sorts that only provides the necessary inertia to cancel felt recoil. Unlike the Feinwerkbau sliding sledge system, the Giss Contra system is completely devoid of any visible gun movement.

I have used my 75S T01 in BRV competition and like how stable and motionless the gun feels during propulsion. Although my 75S T01 is noticeably harder to cock than my FWB 300S, it is still very much in the easy-to-cock category of airguns.

Besides competition, I have also used my RWS 75S T01 for informal backyard grasshopper shooting. This gun provides plenty of accuracy and punch for this type of shooting activity, and it has introduced several non-shooters to the joys of an airgun.



Alan Hanson shooting the QB 77 during Field Target competition.



Author's RWS 75S T01 Match air rifle with a Simmons Pro Air 6-18x scope in B-Square mounts.

**TEST RESULTS/ Oehler 35P Chronograph/
about 6" inches from start screen**

RWS 75S T01

Pellet tested: .177 caliber 8.09 grain Beeman

H&N Match

Velocity:

Hi	622	fps
Low	616	fps
ES	006	fps
SD	002	fps
Avg.	619	fps
Energy	6.88	foot pounds

Average accuracy: compiled from four, 5-shot groups.

All groups shot from an Ultimate Tripod built by McFadden Machine Co., Inc.

20 yards indoors: .21" (18X magnification)

Cocking effort: 16 pounds (factory spec)

Trigger rating: (1= abysmal, 10 = perfect)

Stock trigger: 9+

CHAPTER NINE

Spring-Piston Airgun Tuning

Guest Authored by Ken Reeves



Ken Reeves, left, airgun tuner and field target competitor gives encouragement to a fellow shooter during a match.

What is a "spring gun tune" you ask? Don't feel alone, most who are new to the sport of airguns, especially spring powered, hear the term, but are unaware of the advantages or possible disadvantages of tuning. The only real disadvantage would take place in an improper tune job. When you take your car or, perhaps, a musical instrument in to the repair shop for a tune up, the idea is to get all of the component parts to work in unison. This creates a better performing car, or better sounding instrument. This same principle can be applied to air rifles. The differences between a pre-charged and a spring powered airgun have been discussed in a previous chapter. It is the spring powered gun that can benefit the most from a tune.

Today's modern spring guns, as refined and as high quality as they are, still benefit greatly from a proper tune. First, we need to remember that most all of the guns are production made pieces. In order to keep costs down, the manufacturers need to make small sacrifices in areas that should not reduce the quality of the gun. An example of this is the removal of small burrs and metal fragments left behind in the production and assembly of each piece. While they do not necessarily affect the quality, they can have a negative effect on longevity, accuracy, and smoothness of operation in the gun.

There are different levels of tune that can be done to a gun. There are some who will simply disassemble, lubricate, and reassemble. While this may have some small benefit, it does not allow the gun to perform at its peak. Yes, this may be better than no tune at all, but improper lubricants, improper assembly, and failure to remove burrs and fragments can still cause a premature failure of the internal components. I have taken the tuning procedure into three levels of tune; the standard, the custom, and the modified. The following paragraphs will give a definition of each, and give you a better understanding of which one may be the most cost effective for your type of shooting.

The standard tune is, in my opinion, the minimum a spring gun should receive. This tune should include a complete disassembly of the mechanism. A qualified tuner will have the knowledge and proper tools for your particular type of gun. As the mainspring can be under considerable tension, be aware that if improperly released, it can cause serious damage or personal injury. The internals should be thoroughly

cleaned and de-greased, then inspected for unusual wear, or damage. All sharp edges should have the burrs removed and critical wear points should be polished. However, care must be taken at let off (firing points) at the piston and trigger, as improper polishing at these points can cause an unpredictable firing at re-assembly!! Spring guns come from the factory with the type of lube designed more for rust prevention than actual lubricating qualities. This is cleaned out and a premium quality moly lube that is compatible with both metal and plastics (seals!) should be used upon re-assembly. This also includes the trigger mechanism. Heavy lubes in this area are not a good idea! A good trigger job includes cleaning of the trigger, then a light coating of dri-slide or similar lube, followed by a light oil (very sparingly) into the mechanism. Let excess oil run out; this should give a crisper and more definite trigger release.

The mainspring is designed to rotate as the gun is cocked and fired. If the ends of this spring are rough, it will not rotate smoothly, so inspection and polishing may be in order. If a spring is dry when fitted inside the piston, it can vibrate excessively. While this will create an increase in the velocity, it also creates an uncomfortable discharge. There are many opinions as to what form of lube or dampening compound should be applied to the spring. Everything from light grease to heavy tar-like chain lubes have been tried, but my best success has been with a heavy silicone grease applied in moderation to the spring, making sure each coil gets a coating. Light grease, or oil, tends to fling off before long, prematurely ending its intended purpose. On very low powered rifles, such as the R-7, lighter grease will work due to the lighter springs and shorter stroke. On rifles producing 10 ft. lbs. and up, heavier lubes are a must. I have found that the tar-like substance is usually not compatible with plastics (seals), nor do they have good long term lubricating qualities. The heavy silicone may cost a few feet per second in velocity, but the smoothness and long term protection are well worth it.

Upon re-assembly, all internal parts are checked for proper fit, and coated with a premium moly paste, then heavy friction areas are also coated with a premium moly grease. A quality chamber lube should be applied to the piston seal, and a light coat, (one or two drops) to the inside of the compression chamber before installing the piston. Again, the proper tools must

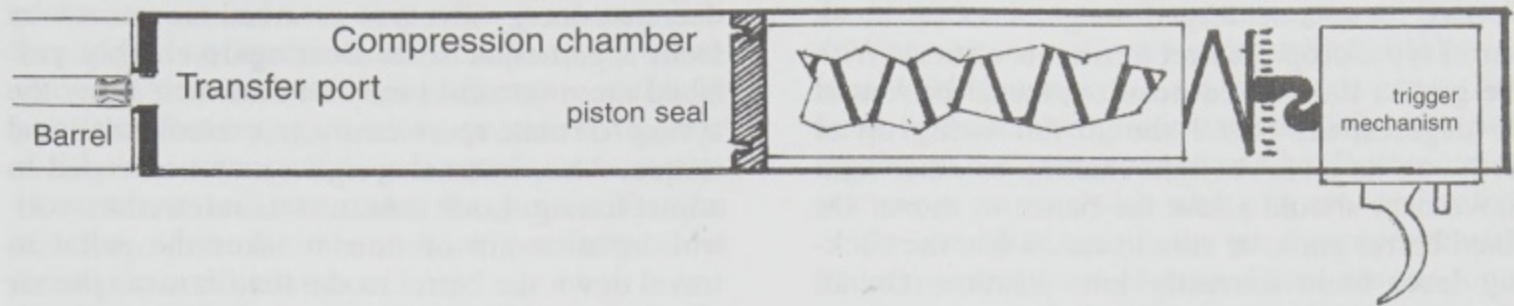


Illustration showing the innards of a spring-piston airgun in the cocked position (mainspring compressed) and a pellet loaded in the barrel. — Illustration by Oscar Davis.

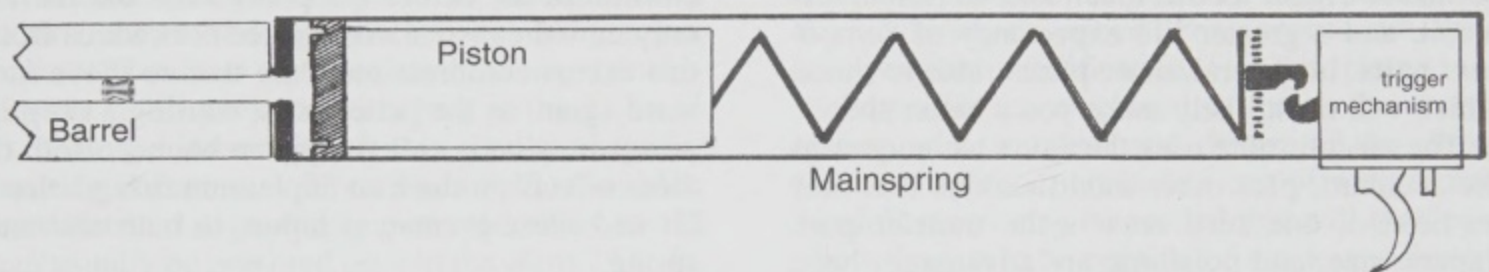
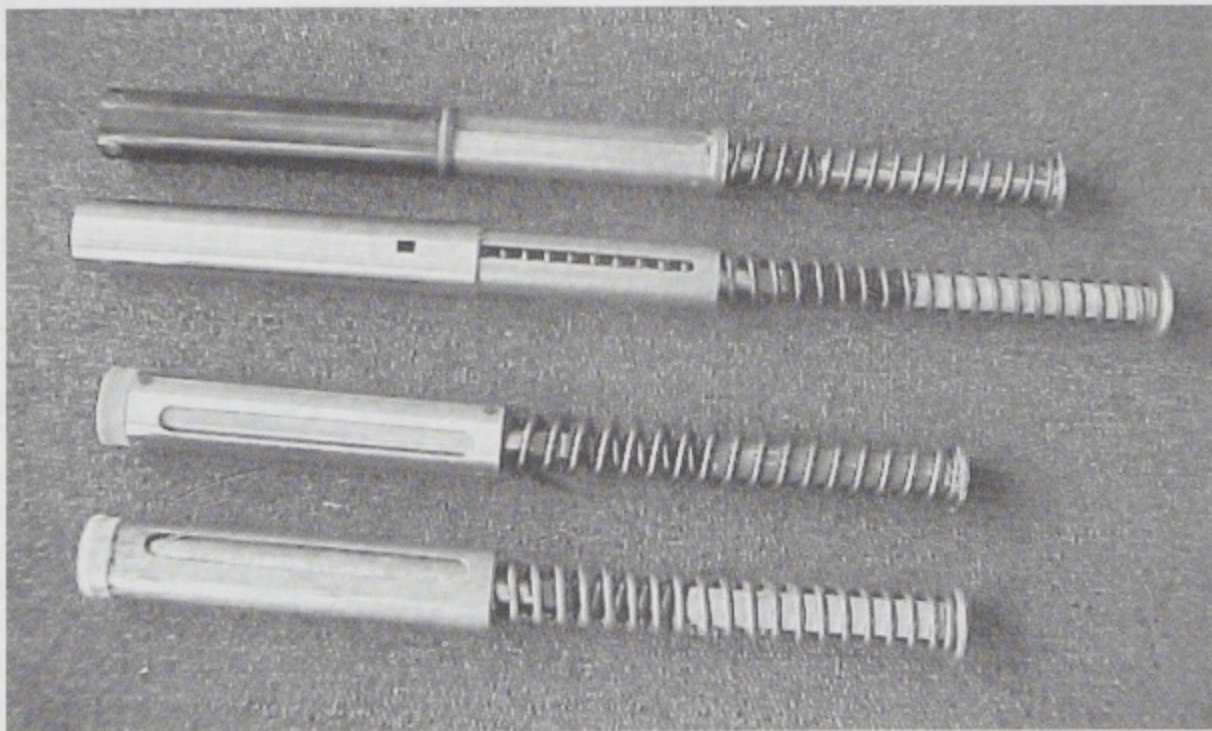


Illustration shows the innards of a spring-piston airgun microseconds after releasing the trigger. Notice that the pellet has started its flight down the barrel, and the piston is near the end of its stroke. — Illustration by Oscar Davis.



Above, four spring-piston air rifle assemblies. Top, a Mac-1 Venom Lazaglide spring and piston, which features synthetic bearings for less friction. Second from top, a factory Beeman R1 spring and piston. Third from top, a Mac-1 Venom Lazaglide spring and piston for the Beeman HW97. Bottom, a factory HW97 spring and piston assembly. — Photo courtesy of Tim McMurray.

be used for re-assembly. If the gun is of the break barrel type, proper barrel tension is critical. With the gun in the cocked position, barrel broken at 45 degrees, the barrel should not swing up or down on its own. A slight shaking or other light movement should allow the barrel to move. On fixed barrel guns, be sure to check that the cocking lever locks correctly into position. On all guns, make sure the safety functions correctly. Never remove or disconnect a safety mechanism, as these guns are mechanical devices, and mechanical devices are known to fail when least expected. After assembly and test firing, you should find a gun that is easier to cock, a more definable trigger let off, much less vibration, less recoil, and a greater life expectancy of component parts. In general, more pleasurable to shoot, which will most likely make you a better shot.

The custom tune uses the same techniques as the standard, plus other modifications that may be needed; one such area is the transfer port. Tapers, size, and polishing are advantages here, but need to be done according to the specific characteristics of each gun. If too much is removed, it can't be put back! On my custom tunes, I also check the loading port to see how the pellet seats. Burrs are frequently left here, very small, maybe even microscopic, but this burr can distort the pellet as it begins its journey down the barrel. Careful chamfering, and/or polishing, may be needed, but again not too much. After-market mainsprings will often increase or

decrease energy levels to get maximum accuracy from a particular rifle. Bearings or highly polished races (washer) may be added to allow the spring to rotate more easily to control rotational torque. Also, internal weights may be needed to adjust timing. Lock time, as it is referred to, controls relationship of time it takes the pellet to travel down the barrel to the time it takes the air to compress and the piston to reach the end of its stroke. If the pellet exits the barrel before the piston bottoms out, a severe jolt takes place as the piston slams against the end of the compression tube, due to a lack of an air cushion. A similar effect takes place if the piston builds too big a cushion of air before the pellet exits the barrel, only now the piston will bounce backwards from this excess compression. Only then to move forward again, as the pellet exits, causing a drop in power in what is called a piston bounce. Both of these effects produce an unpleasant firing behavior and cause premature failure to both seal and spring.

Certain guns can benefit from a tuned trigger, some a complete cleaning, lube and adjustment, while others require more serious work. An example of these would be the RWS line of guns with the three ball trigger mechanism. These are capable of becoming a very good two stage competition unit, rather than the heavy sporter version that comes from the factory. A complete disassembly, removal of burrs and replacement of springs within the trigger is required. On some



You know Arnold our "super ultra-power" tuned air rifles really don't shoot any faster than the regular factory models, but they sure give us a good workout!

(Airgun tunes that feature significantly more powerful mainsprings may not always increase velocity. In fact, sometimes they may actually decrease velocity while increasing cocking effort!)

— Cartoon by Oscar Davis.

of the import and economy rifles the heavy factory triggers offer no means of adjustment whatsoever. These additional modifications will help you, the shooter, gain more precision in your ability to shoot the gun more accurately. However, it will not make the gun itself more accurate, just smoother, more consistent and more pleasurable to shoot.

Many feel that a tune should automatically increase the power of the gun. In some cases it may, especially if major modifications are made. Some guns need to have their power reduced to achieve their best accuracy. Some guns are designed for a certain level of power and cannot be altered. After many years of tuning, I have drawn the following conclusions. In general, most .177 caliber air rifles used for target shooting out to 60 yards perform best in the 11 to 16 ft. lb. range. If more power is needed, perhaps for hunting situations, a .22 caliber air rifle should be considered. Large spring powered rifles in .22 can usually be powered up into the 20 to 25 ft. lb. range. For match type target shooting at distances less than 30 yards, the best accuracy is usually attained in the 5-6 ft. lb. range. Most factory 10 meter match rifles fall into this range and are quite capable of putting all the pellets through the same hole, with little or no recoil.

To give an example of over-powering, let's take a look at a very popular air rifle, in the RWS line, the model 52. It is available in both .177 as well as .22 calibers. I have found most manufacturers tend to stretch their velocity advertising just a bit. These RWS side-cocking guns are rated to 1100 fps, in .177 caliber. Testing is usually done with a very light weight hobby pellet, which, unfortunately, throws off the timing immensely. Severe recoil and a very unpleasant firing behavior takes place. Moving to a heavier pellet will give a slight advantage, by helping to slow down pellet travel thus improving the timing slightly. The .22 caliber version of this rifle is generally a bit smoother out of the box, for this same reason – heavier pellet – better timing. Now is where a de-tune becomes a real advantage for the .177 rifle. Most .177 pellets do not fly true at velocities much over 900 fps. To get the smoothest performance and most accuracy from this rifle, experience has shown that tuning to (13-15 ft. lbs.) 850-900 fps, will give the most from this particular piece. If more power is required, move into a .22 caliber rifle, as power levels will be higher (20-25 ft. lb.) due to the heavier pellet. Velocity will be in the 775-835 fps range, with

the heavier pellet giving the extra power. There is an ongoing controversy over which caliber is best, each having its own pros and cons. Just keep in mind the smoothest shooting rifle will make you the best shot you can be. Power means nothing if you can't hit what you are aiming for.

The modified tune is the most comprehensive and expensive form of tune. These are the tunes for the extreme accuracy aficionados, those seeking the Rolls Royce of air gun performance. To benefit from this tune, a shooter needs a very accurate gun to begin with, then internal modifications are made to match the individual gun. Modified tunes can take many hours of testing to find what particulars a gun may need. Along with the previously described tuning procedures, there are possible modifications to the piston and seals, guides are machined to match the spring, testing with weights, and timing of the piston travel; all play a part in this one of a kind tune. Modifications may be needed that will no longer allow the gun to be considered stock, and factory parts may no longer fit. An example of this would be an HW-80 (Beeman R1) in .22 caliber, that was done five years ago. I was trying to get the best high powered spring rifle that I could create.



The rockchuck above was taken cleanly with the help of a power-tuned twenty-two foot-pound Beeman R1 in .22 caliber. Some spring-piston models (like the R1) are more conducive to power tunes than others.

I wanted a break barrel, as it would be used for hunting and pest control, and these are easier to cock and load in the field. Six months of tuning and testing to find what this particular rifle liked was needed to make it powerful, smooth and accurate. It now includes a modified trigger block to accept a custom spring guide, reworked trigger mechanism, modified piston, custom made seal, modified transfer port, modified special spring, modified unchoked barrel, modified breech, and a barrel weight to tune harmonic vibrations. Lock time is very quick, recoil is minimal, and cocking effort is half again as heavy as original. The finished gun, after all the tuning and experimentation, shoots 14.3 grain pellets at 835 fps (22 ft. lbs.) and consistently shoots sub $\frac{3}{4}$ " groups at 55 yards from a sand bag rest. Due to the fast lock time, it shoots extremely well offhand, even at 50 yard distances. The cost of materials, plus the time for testing added together, can easily exceed the original cost of the gun itself; however to some, it can be the ultimate!

The standard tune will always be the most cost effective, and will show the most dramatic improvement on a gun, when compared to one straight from the factory. Followed by the custom



Above, a peek into the Beeman airgun workshop showing a factory trained technician at work. A potential downside with some custom tunes is that the factory warranty is rendered void.

— Photo courtesy Beeman Precision Airguns.

tune for those serious accuracy freaks who want the best from their air rifle. For a price, the modified tune can make a gun as near to perfect as that particular gun can get, but may have some negative effect as a collector's piece, due to the many modifications required.

I recently tuned a rifle for the author of this book. It was a brand new RWS model 46 with a beautiful Mannlicher style stock. Out of the box, the rifle had an excessive twang or vibration upon discharge, heavy trigger pull, and the chronograph displayed a velocity about 80-100 fps slower than it should be. A careful inspection found a breech seal had been left off, or fallen off in shipping; in any case it was missing. Replacement of the seal gained about another 50-60 fps, which put the rifle on the low side of typical factory performance. Disassembly showed typical sharp edges and burrs left during manufacturing. Diana factory springs have a tendency to be a harder and more brittle wire than most of the after-market springs. This gives them increased velocity, but generally a shorter life span. A spring with a square section wire, rather than a round wire, was used for this tune, as they have proven to give a smoother discharge in rifles below 13 ft. lbs. We also noticed an enlarged opening at the end of the compression tube, where the compressed air exits. I normally add a small chamfer to this area, but some factory technician beat me to it. Unfortunately, his chamfer is much too large, and once this material has been removed it cannot be added back. Therefore, we had to live with it, even knowing that it would cost us some velocity in the final outcome. A complete trigger job was performed; replacement of trigger springs and proper lubrication made a very nice, crisp two-stage let off. The piston seal edge had been nicked when assembled at the factory, but fortunately my seal modification technique removed these and made it better than new. Careful deburring and polishing made it ready for re-assembly. With the moly lubes in the correct locations, the new spring and guide were coated with dampening compound and the action was put into my spring compressing vise for final assembly. After assembly, a couple of cocking and uncocking procedures proved that all mechanisms, including the safety, were functioning correctly. A dozen or so test shots were made to clear any excess lube from the compression chamber, then the chronograph was turned on to tell the real story. The first few

shots showed over 800 fps, a real improvement from the 700 fps when it came in. After 100 shots and everything settled in, we were averaging 805-815 fps with a Crosman Premier 7.9 grain pellet, plus easier/smoothier cocking and firing behavior, and a lighter, crisper trigger release. We had gained a total of 115 fps with a maximum deviation of 12 fps, when previously it was 35 fps. The tuned rifle has less recoil and in general, is much more pleasant to shoot. Not all tunes will give this degree of improvement, as we did find some flaws from factory assembly that had hampered our initial performance, but they would not have been found, and the rifle may have been passed off as a bad example, if not for the tuning procedure we performed.

Even after a quality tune, real accuracy comes from the choice of pellet. Not only the shape of it, but also size (diameter) and possible pellet lubrication should be experimented with. We must also address the skill of the shooter him or her self. A well tuned gun, shooting the pellet the gun prefers, will allow the shooter to get his personal best from that gun.

Experience the real pleasure of spring gun shooting, get it tuned!!!

Ken Reeves

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Epilogue

(Author: Thank you, Ken, for providing a great chapter. I have been a fan of airgun tuning since my very first tune. Another benefit of tuning that might have been overlooked is spring replacement and longevity of the cocked spring. This is a topic that airgun hunters should find interesting. Airgun hunters have the possibility of leaving their gun in the cocked position for several hours at a time while waiting for their prey to appear. The hunter shooting a spring-piston gun is frequently reminded that his/her mainspring will soon fail if the gun is occasionally left in the cocked position.

Ken Reeves has informed me that some factory mainsprings do indeed fail sooner, when left cocked for long periods. Ken also went on to say that a good quality after-market mainspring will last longer and will normally not suffer any ill effect when left in the cocked mode for a few hours at a time!

A while back I had an opportunity to test this theory, using after-market replacement springs. I was in a friend's garage all weekend, hand-loading ammunition. Just outside the garage was a garden, which the local crows and magpies were trying their darndest to destroy. I kept two loaded spring-piston air rifles handy just inside the garage for quick shots at the offending varmints. One was my .22 caliber TX200, which was kept ready for short-range use. The other

gun was my somewhat louder .22 caliber Beeman R1, which was used intermittently for longer-range opportunities. Both of these Ken Reeves tuned rifles feature very good quality after-market mainsprings.

In my effort to save the garden, several crows and magpies were killed via my air rifles during a morning raid. However, after my initial barrage the critters appeared skittish, and I had to resort to a little trickery to thin the remaining marauders. I left the air rifles loaded and cocked while I went about my business of reloading. (As a safety precaution, I remained with the loaded airguns at all times.) About every 1½ to three hours I would have an opportunity to fire a quick shot or two from my garage hideout. For two days straight my air rifles remained loaded and ready, and despite being left cocked for several hours they suffered no reduced velocity or any other apparent maladies. You see, I checked the velocity of my air rifles the night before and again immediately after my reloading was completed, and the chronograph showed virtually identical results! After my little velocity test, I am inclined to believe that I have nothing to worry about when it comes to keeping my tuned guns cocked for several hours at a time. However, I definitely would not push my luck and leave any airgun cocked overnight.)

CHAPTER TEN

Building a New PCP Airgun for the Sport of American Field Target

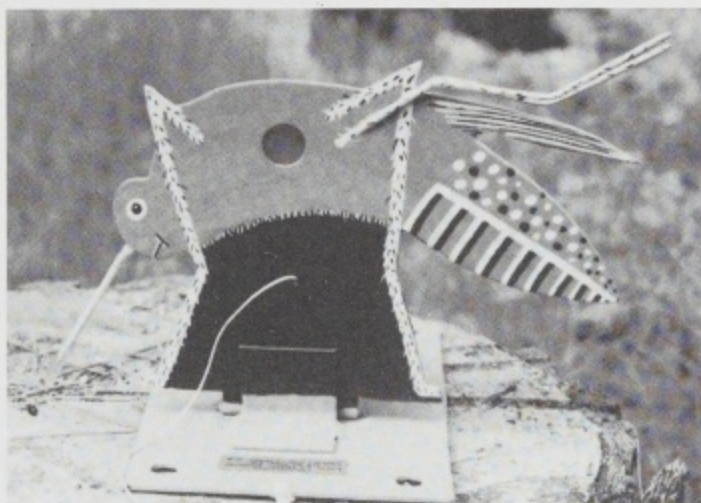
Guest Authored by Larry Durham

All photos by Larry Durham



Larry Durham shooting his homemade airgun creation.

Now this is a story related with the relatively little known, but very addictive, shooting sport called Field Target, which requires skills similar to long range varmint hunting and precision outdoor small bore target shooting, but using air rifles. The principal features setting the game aside is the near lack of restraints on equipment requirements. The non-standard targets vary in size and range, and the course layouts, which can be anything from a formal flat grassy field with targets in rows of lanes and various distances, to a dark wooded forest with half hidden targets (some in trees), or a hot, windy desert ravine with cross-canyon shots and hiking boots and snakebite kits standard fare by some.



Field targets with small hit zones, such as the giant mosquito above, require an unwaveringly accurate air rifle.

Now anyone in the target shooting game knows precision rifles are finicky beasts, and I believe that pre-charged airguns used outdoors may just be the fussiest of the LOT! It seems that subtle changes in temperature, humidity, altitude, and even direct sunlight on one side or the other of a tack driving rig can be justification for some competitors to CLAIM notice of a souring of accuracy. I'm a normally pretty logical kind of guy, but I, too, am of the mind that the aforementioned list is only an abbreviated one to draw from, when I miss a few targets!

Two paths to take, and what to do? When we first got into the game, most trotted out a store-bought break barrel, or under lever spring piston gun, clamped a moderately priced variable power scope on it, and, using whatever roundhead pellets they could find locally, they blasted away at the targets, having a good old time and probably

knocking quite a few down, but wishing for more. Most then came quickly to an imaginary crossroads, often promoted by noticing the fancy shooting sticks of other competitors, fueled by the knowledge that THEY, for sure, were gonna do better next time! The smart "crossroads" decision was for taking the first path, the one of deciding to knuckle down and practice really hard, learning the best positions and wringing the most they could from the kit they own... but the second path, that of quickly obtaining some higher zoot accessories and equipment to enhance the shooting prowess one KNOWS he already possesses, is usually the most attractive.

Many take the first path, and, since all other things being equal, matches are won by those most practiced and familiar with their equipment. Some stay on this path forever, being content to enjoy the sport and compete with themselves, rather than the equipment.

But, most of us take the second path, or wander from the first towards the second after a few short months, eventually falling prey to the lure of a shiny new pre-charged rig, custom-built across the pond for the EXPRESS purpose of knocking down those iron crows, hedgehogs, and pigeons with unerring accuracy, to the admiration and envy of our club mates! I took the first path for a little while, banging away with an old HW77 for a couple years, but eventually succumbed to the lure of the pre-charged guns. Oh yeah, I went back to the springer frequently, but my real squeeze is still the PCP.

PCP's aren't all roses though: I had been whining and complaining that the new field target rifles were really nice, but, since the advent of the regulated models, they were getting so darned complicated internally that many shooters, including myself, were taking to bringing a SPARE rifle to matches, in case the main gun developed a problem! Folks were routinely sending guns back to their makers, or aftermarket tuners, for hurried service before a "big match", hoping no mysterious gremlins would appear to plague them during their long awaited sojourns to distant fields to do battle with their competitors and the elements. Additionally, since most field target guns were originally designed and built to perform with the sub-12 fpe power level of the UK, they often soured a bit and got even MORE finicky, when bumped up to "American" power standards. Lately, many have taken to using guns originally designed for formal 10 Meter shooting, but "bumped up" in power to

meet field target needs... this usually creates more problems, since many of the 10 meter parts are really not rugged enough for outdoor use at the higher pressures and loads being imposed, plus they still have most of the problems that the purpose-built UK guns have.

As the game progressed, and courses got more difficult, targets got smaller and smaller, matches longer, the ante was upped for very precise guns that are stable, day in and day out! I saw and experienced problems with my guns when the weather suddenly changed from cold to hot, or worse yet, when it rained cats and dogs! Oftentimes, after traveling across a few states to shoot a two-day match, it was found the gun wasn't shooting right, with shifted zero, lowered velocity, opened up groups... what a consternating MESS! In the effort to eke out better accuracy, some shooter/tuners were trying for incredibly small deviations in velocity, resorting to not just one, but even two internal regulators, and even then, taking only the best 18-20 shots per charge before topping up again (meaning they had to have a tank strategically placed part way into the course, often refilling three or four times (or more) a day!

Why not build my own? Being an ex-machinist and retired Engineer, plus having some shop equipment in the garage, I decided to build my own rifle on a dare and a whim. I like to build things, but feel I need to have something of myself in it... something a bit unique to express, or why bother? I didn't feel I had the experience and understanding to build a decent spring gun, nor did I have any well thought out novelty idea that might improve the breed if built. But, I did feel I had a few ideas for a pre-charged target gun that COULD just end up being a little better than what was currently available.

Now don't get me wrong here, there are lots of shooters pleased as punch with their guns as received, and many have never noticed any of the quirks I'm attempting to address. I personally own some pretty decent field target guns that do ok! But, I'm a finicky guy, and mostly want to try my hand at building a better mousetrap.

Using my trusty AutoCAD program and mental doodlings, I began sketching out various ideas, applying mostly proven concepts from various simple, accurate firearms as well as some airguns I was really familiar with. Early on, I hit on a couple of novel ideas that seemed to solve several issues at once and would prove to be the

really exclusive wrinkles that set the design apart from all others. I decided the gun would have not a stock in the conventional sense, being mostly really stiff machined aluminum hunks, allowing stability in any shooting weather. It would be relatively heavy for reduced recoil and balanced to reduce movement from heartbeat jump. I would rely on the stout Weaver base mounting system for added scope mounting stability, and the entire gun would be canted toward the shooter's eye to around 20 degrees, to give a more relaxed hand and face position, as well as give a really unusual "alien" look. A pressure gage would be visible from the shooting position to indicate goings-on inside, and the pressure fill port would be opposite the gage, instead of near the muzzle, to allow for ease of service.

Now, I didn't want to go into the "business" of producing these rifles, I just wanted to be able to demonstrate that a simple American rifle could win matches too. I did want a small lot of them in the hands of some experienced Field Target competitors, actually shooting them in matches across the country to see if my theories work out, since, personally, I am not a world-class shooter. I decided to make up to a dozen guns at reasonable cost, should my prototype work as intended (and should demand warrant).

Building the gun in stages:

First, I worked on the computer a bit more, fleshing out my design, asking as many what-ifs as I could think of, playing Devil's Advocate, and trying to make sure I had most of the answers. When I had my concept drawing finished, I began making detailed drawings of all the parts. Once the detailed drawings were done, I went over them again, asking myself about the materials, loads, strengths, durability issues, etc.

My objectives for a new FT prototype rifle were:

- ~ Meet the accuracy standards of around 1 moa (average half inch center to center for five five shot groups) at 50 yards in ideal conditions.
- ~ Deliver at least 50 very accurate shots per charge somewhere around 850fps to 925fps with 10.5gr pellets.
- ~ Fit well enough for me to be at least as competitive as I am with my current field target guns in actual competition.

- ~ Have a two stage trigger, not scary light, maybe 5oz 1st stage, 10oz second, with NO adjustments.
- ~ Be easy to maintain, designed to not require ANY internal maintenance.
- ~ Extremely reliable, possessing obvious features that instill confidence.
- ~ Capable of being duplicated at reasonable cost in my garage.

Finally, after stalling around for what seemed like (and maybe was) months, I began buying raw materials and basic components. All non-moving parts, except bolts, pins, and springs, were to be made of aircraft grade T6 aluminum. All fasteners of hi-tensile stainless steel, pins and shafts of hardened tool steel, as are all moving parts such as hammer, trigger assembly, etc., springs to be mildly loaded compression coil units from a popular supplier. Valve head of hard white delrin, with tool steel shank, o'rings are high durometer polyurethane, good for ten years or more!

The Barrel:

Making a good airgun barrel in .177 caliber is all consuming, and would probably cause a failed program. I know how hard it is to make barrels, and have no reason to believe I could come up with a barrel better than what I could buy for a very reasonable price from my favorite airgun supplier! Actually, this program was already in the back of my mind when I helped Tim McMurray of Mac-1 airguns spec out some good barrels from famed gunmaker Hans Weihrauch, and by the time I was ready to buy some barrels,

Tim had already just received his second shipment, a large one of over a hundred from Germany! Now I'm fussy about barrels, and I know Hans makes some good ones... but I still sorted thru Tim's shipment, until I had a baker's dozen for "my guns."

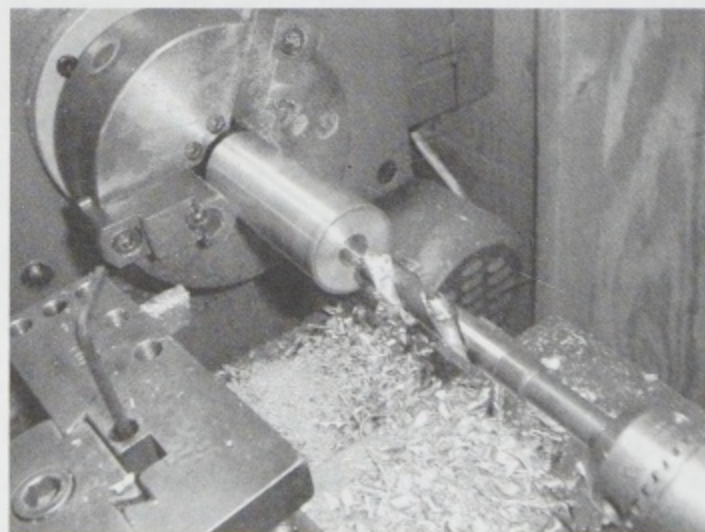
The barrels I asked for, at a bit over 25", were longer than any extant field target barrels, a plus for velocity and efficiency. They are also thicker than most, at a full 16mm diameter to squelch vibrations better, and stiff enough to be free floated very effectively. I had already tested some of these HW tubes in other airgun projects, finding them accurate and not fussy.

The barrel is tightly mounted in a 1 7/8" diameter solid billet that fully supports the barrel for nearly 4 1/2". The barrel block is cross bolted, using four cap screws through the reservoir and deep into the receiver billet, helping to retain the receiver in the reservoir, while it pins the block to the reservoir. A solid, 3/4" thick Weaver style base is then bolted into a shallow recess in the top of the barrel support block. I couldn't think of a stronger practical setup, or I probably would have used it.

The Reservoir Tube:

A thick-walled 49mm tube, with an inside diameter of around 41mm, set up to hold air for about 560mm of its length, gives a capacity of well over 700cc. I knew a tube of this magnitude could suit my needs, and, if made of aircraft grade T6 aluminum, it would easily contain the sub 2,000 psi charge I envisioned with ample safety margin. A fellow airgun nut and internet buddy, Dave Matticks, was kind enough to test a sample piece up to 6,000 psi for me, finding it didn't split, but there was some stretching at the fastener holes. I knew the gun would never see 6,000 psi, so I felt confident, but I still added a few extra fasteners to the end plug design, just in case. Of course, as always, I would pressure test the actual completed reservoir, but to 5/3 working pressure, not to destruction!

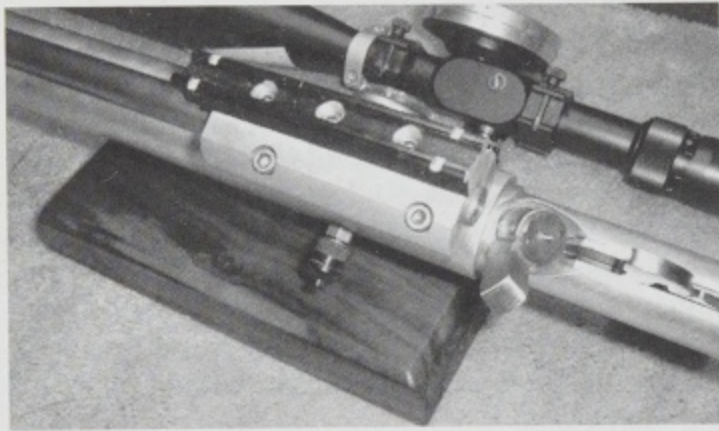
The tube would be plugged at both ends with solid bars turned to suit, with six cap screws that are threaded in radially to secure each. The calculated thrust could be held with three, but six make it safer. I didn't thread the tube, as this weakens it by thinning the walls, plus the design is simplified with the cross bolts.



Drilling the barrel support block.

The Receiver:

A solid billet of 2" diameter is milled and turned to accept the reservoir, angled firing valve, fill valve, pressure gage, gripframe, hammer spring assembly, and sliding buttstock assembly. The cheekpiece also bolts to it... it's one busy piece of work! Since it's made from the solid, it's stiff and stable enough for all the major parts to be bolted into, and, except for the front plug and sliding buttplate assembly, all parts DO bolt to it!



Top view showing the Weaver type scope base and the air fill valve on the side.

The Stock:

Well, there is no "stock" in the conventional sense! There is an adjustable metal buttplate on a metal shaft that sockets into the receiver, and a thick wooden forend block bolts to a thick "I" shaped metal hanger, in turn bolted up thru the reservoir tube into the receiver. A bit of wood bolts to the receiver in the area the shooter's face needs to touch, and there is a carved wooden grip bolted to the aluminum gripframe.

The "Firing Valve:"

The firing valve is a sort of conventional poppet-type valve with a few wrinkles... for one, the valve head is quite tiny, and the valve stem is thin as well. The valve body is machined from 303 stainless, and has a unique carbide valve seat silver brazed into place, providing a near diamond hard surface that should eliminate one of the old maintenance problems with pneumatic valves; that of a hard bit of detritus making a little dent, or scratch in the seat, causing it to leak a bit... I figure one could even take steel wool to this seat and not hurt it! The valve body has a

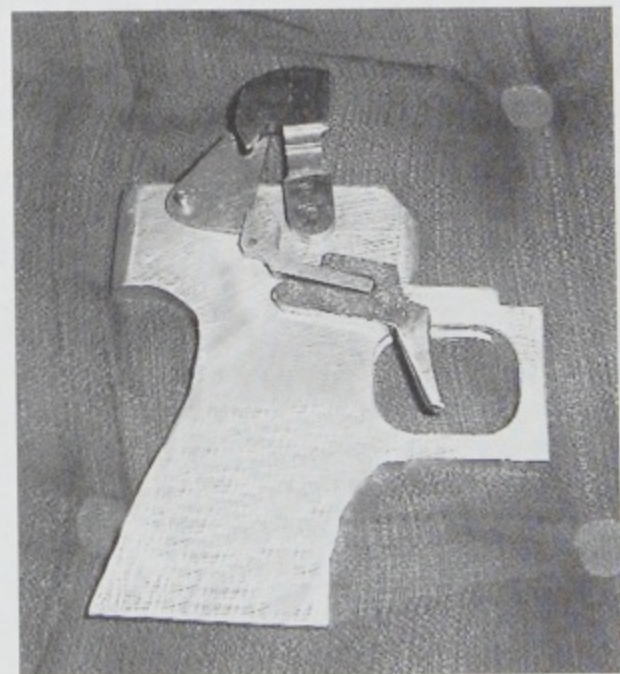
rotating delivery transfer port/cum breech block that aligns the air blast into the back of the pellet when swung closed, and allows easy finger loading and seating of the pellet when swung open (no fiddly little ports under the scope that need a bit of practice to flip the pellet in just so-so for this guy). The valve is threaded into the receiver via stout long 5/8"-18tpi on the body, at around 40 degrees off horizontal, with a special pin spanner used to snug it down against a poly o'ring nestled in a supporting recess.

The Hammer Assembly:

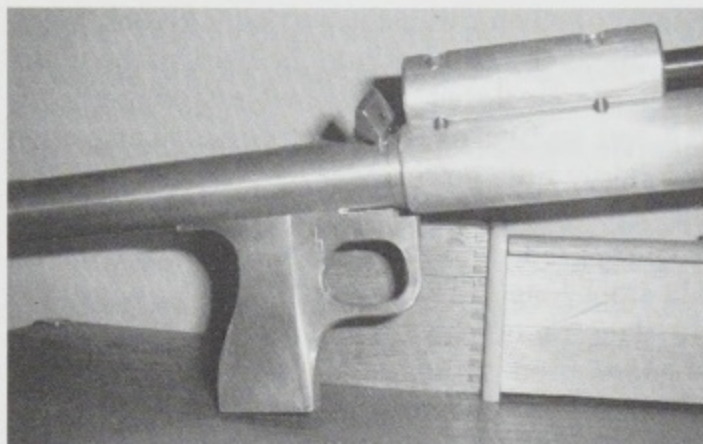
An exposed hammer design allows easy thumb cocking and decocking. It is relatively short and light, since the tiny firing valve and low air pressure don't need much to do its work. Using a small hammer assembly reduces accuracy-robbing changes in friction associated with different states of lubrication and temperature. The entire hammer, sear and trigger assembly are mounted inside the gripframe. The hammer spring is in a receiver-mounted housing inline with the hammer, driving it thru its arc via a piston and strut arrangement. The spring is intentionally quite long, for its movement needs to provide extended life.

The Trigger:

The two most important parts of a match gun are often said to be the barrel and trigger. I



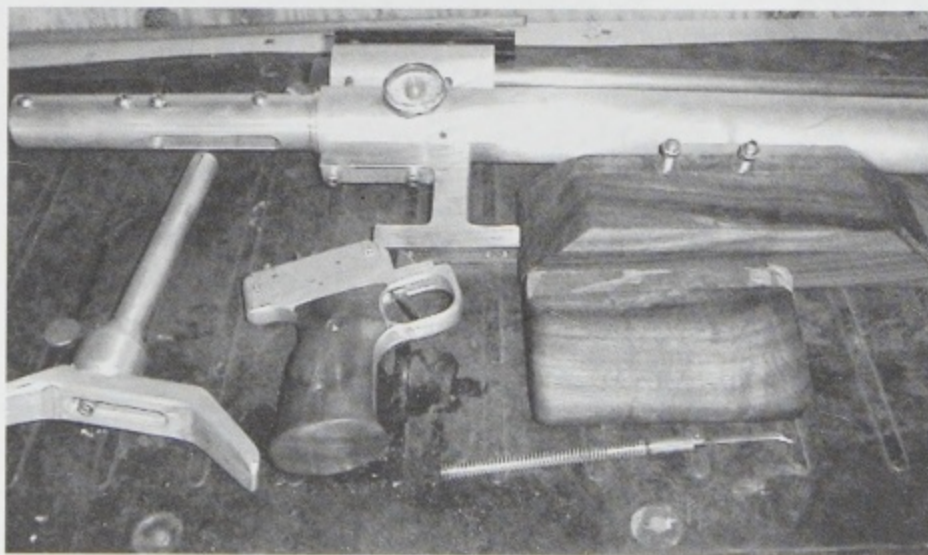
Trigger and hammer relationships. All parts just roughed out at this stage.



The airgun is taking shape and is about half done at this point.



View shows the adjustable metal butt-plate on a metal shaft. No grip panels yet, but the rifle is finally ready to test-fire!



Disassembled gun, getting prepped for packing.

wanted a good honest barrel and a good honest trigger, but with no frills! The trigger I designed is a solid assembly of stout levers and pins that serve to hook and hold the hammer in position. A relatively long first stage takes up all the slack and the short, relatively light second stage fires the gun. The design is intended to be reliable, but not flexible. There are no adjustments possible, except by replacing the one spring in the unit, or by stoning something. In this manner, I hope to shoot and not fiddle. All parts are hardened, and loads are light, so I'm hoping it will be a trouble free unit.

Building the Thing:

Using a combination of hacksaw, file and other hand tools, as well as my bench grinder, belt sander, and medium sized vertical mill and 12" lathe, in stages, I made the reservoir, end plug and valve body, then put them together with o-rings and trial bolts. I marked some locations on the tube and carefully measured and recorded the diameters.

Now, to see if the thing would "hold"! I filled the assembled tube with water, then hooked up a high pressure air line from my tank and "sloooowly" brought the pressure to 1000 psi and held it awhile before letting it out. I re-measured the tube... good, no change! I repeated the steps in 500 psi increments till I had reached the limit of my 3300 psi tank. Ok! No stretching!

Little by little, I carved about 50lbs of steel and aluminum into around 10lbs of metal that still didn't look like it was going to be an airgun! Along the way, I was challenged by problems on just HOW to make a particular part according to my drawings. Sometimes I modified the "bee-jesus" out of the part in comparison to the drawing, in order to make it happen; other times I made special tools or fixtures, sometime using methods that would make pros in a tool room cringe. I used a blade designed for a skill saw on a home made arbor to cut a deep recesses in aluminum using my mill, and re-contoured router bits to cut dovetails in both steel and aluminum!

I had to search high and low to find some of the fasteners and

materials I used, and I'm much beholden to some of my Internet friends that came thru by mailing me bits and pieces they had on hand. Yes, all through the steps of design and build, I was sharing many of my experiences with enthusiasts via email, and even on some of the airgun Forums on the Internet! Also, my longtime buddy Tim Curry was invaluable in providing bits and pieces, as I needed, plus vital encouragement to keep going.

I went back and forth on many of the parts, redesigning here, remaking there, either due to accident or discovery, until finally the gun was actually firing! From the first, it was obvious that I had it about right, as the objectives regarding power end efficiently were seemingly going to be easily met from evidence I saw the first night I tested the sight-less, trigger-less chassis! I blazed through and got the trigger group going, so I could get on the chrono, and, after a few days, I was ready to get a scope on and begin accuracy development!

Testing the Prototype:

Over the many years I have been fiddling with airguns, I have found the value of accuracy testing at short range such as 10 yards, or even 25 yards, to be quite limited if the gun is to be used for much longer ranges. Apparently, a peculiar thing happens to the little pellets as they reach around 40 yards, and otherwise well behaved pills begin drifting off in all directions, sometimes making extrapolation of short range study invalid. Now, I'm not meaning that bad shooting guns at close distance will get better at longer ranges, I just mean if you NEED to shoot the gun at longer ranges, you need to test at longer ranges!

Also, I have seen many a shooter claim airguns cannot usually deliver best accuracy off the bench, but I have never tested an airgun on the bench that I can deliver better groups in any other body supported position, though I'm not saying others can't do it. So, for me, I have found ways to get decent performance off the bench, and that has been my standard way of testing intrinsic gun accuracy, as opposed to how well it

might do in other standard positions with the shooter's skills added in.

Earlier in the year, I had fulfilled a kind of long term dream for myself, by building a fifty yard underground firing range, and now its value really began to show itself, as bench testing for long range accuracy in various temperature conditions without the old "wind bugaboo" was a real delight!

At my home in the summer months, it's not uncommon to see 90°f in the shade, yet a couple days later it might drop into the mid fifties in the wee mornings... just right for testing for zero shift in various temps! Since I had designed my "shooting house" to also double as a shower room/cum changing room for use by our grandkids in the our big outdoor wading pool, I could turn the shower on for a bit, when the heat was up, and let the humidity rise in the shooting house, then shoot a bit more to look again for zero shifts! I was very pleased to note the gun was VERY stable, with minimal, if any, changes on the fifty yard group centers!

I was really delighted with the ease of getting really good accuracy from the rifle right off! I spent a good bit of time getting the scope mounting rail at the angle I wanted, one that would allow a good zero distance with the scope in the middle of its vertical and horizontal travel, and allow the mount to be swapped end for end to allow right handed shooting! And with each angle change, the forend had to be modified to maintain proper relationship; because the gun was canted, the forend was made so the gun would sit flat on the bench for accuracy testing.

I made a short tunable muzzle brake (not to be confused with a moderator) of black delrin plastic



Profile of the first gun, which is left-hand, so cant is opposite.

that both cut muzzle jump so as to allow seeing the pellets arc into the 50 yard target, and to dial in the harmonics to tighten groups with various pellets. (I still ended up settling, for now, with the ever popular 10.5 Crossman Premier, though the Beeman Kodiak match pellet was about as good.)

When it was all said and done and I felt ready to do battle, the gun had met all my original objectives and, in fact, some of the fifty yard groups I had fired were astounding! On occasion, three shots on the paper looked like one shot, and five shots looked like a hole from a .22 caliber gun! A fifty shot group of consecutive shots from the same charge could be covered by a quarter, with nothing hanging out!

I had also designed a sliding breech cover that cocked the gun, as it was withdrawn, to allow access to the loading port, and acted to deflect any air blast from the valve stem away from the shooter's face. The wooded cheekpiece sliver was mounted to the sliding cover.

Second Gun:

After a few weeks of fiddling with the prototype gun on and off, I began shooting it in our club matches. I was very pleased with my results, as I was placing as well, or better, than I had with my Steyr. Heck, after a few outings, I even owned my class, and, a bit later, won overall!

Anyhow, during the first few weeks of testing I got feedback from other shooters and got a feel for some possible minor changes I could make myself. I began building another gun so I could continue shooting the first one, while putting the modifications into the second one, and maybe updating #1, as time permitted.

I had already learned the shot count was way more than enough, with up to 75 consistent shots on tap, so I decided to build the second gun a couple inches shorter. I also wanted the receiver shortened to allow the gun to be shorter when "taken down" for transport. The sliding shroud over the hammer assembly turned out to be unnatural to have to close, after loading the gun and closing the breech, so I eliminated it and found the simple expedient of adding a slight concave shape to the hammer efficiently redirected any errant air blast forward, away from the shooter. I also dispensed with the tedious ambidextrous feature, which, though it made swapping from left to right easy, was a pain to

build into the gun, and of little real value to the dedicated user. This second gun was to be strictly a right handed gun, tentatively slated to go right into the hands of a well thought of Field Target competitor that I knew of "back East".

At almost the same time I needed it, I had the great fortune to come across a good supply of beautiful aged Koa wood, a honey colored wood with rich dark streaks, as pretty as real nice walnut, and lighter too! The best part was the price! So I took this opportunity to make the grip, forend and cheekpiece from a particularly well figured piece! This second gun was coming together pretty quickly, while I continued to shoot the first gun in local club matches, generally improving my results with each outing, but often slumping back into the middle of the pack due to errors or oversight, as is typical for me!

Finally, the second gun was done and in testing proved to be as good, or maybe better, than the first! It shot a little hotter than the first, "liking" a bit over 900fps, where my #1 gun preferred 875fps... yet this second gun, though a couple inches shorter, got about as many good shots as the first from a slightly lower charge pressure! Both guns are tack drivers, but the second one is a bit quieter, and in using less air for more power, made me even happier than the first! I had changed the hammer geometry slightly in the second gun, making service of the spring a bit easier, and perhaps this tiny change in timing and weight did it, or perhaps it was the longer spring housing and spring? Anyhow, the next ones may more closely follow this second gun pattern.

Proof of the Pudding:

I shipped that #2 gun to Steve Schulz in Maryland for him to try out, and though he HAD wanted to use it for the upcoming National Championships, he got the gun with almost no time to really familiarize himself with it, in my opinion. That said, he began using it right away in local matches, doing really well, and when the Nationals opened up, Steve was tied for first on the end of opening day! I wish I could say he won (wouldn't that be a fairy tale story?), but he dropped a few too many in the second day, mostly, (I think) due to me not reinforcing my view about barrel cleaning to him, but maybe not. Anyhow, he bounced right back in the hunt on the third day, ending up in the top ten, which



Steve Schulz sights in gun # 2 at the AAFTA National Championships.

is way better than I could have hoped to do myself, and darned respectable for anyone, much less with a brand new gun!

The Production Batch:

Even Steve's gun is a prototype, since it varied slightly from the first in a few details, and is under testing. Nonetheless, I began building five more guns at the request of other Field Target competitors I knew, and they are well underway. These guns will be about the same as the second gun, maybe a little teeny bit shorter, yet. Due to the manufacturing conditions, (my messy garage, antiquated and limited equipment) and work force (me, a retired person with many other interests, pastimes, and duties), the production of these guns is, perhaps, needlessly tedious and slow. Additionally, as is my nature, I have a near impossible time trying to get worked up about neatness and stylish appearance of my creations, so these guns, like the first two, will have a decidedly home built look, with no snazzy polished anodized surfaces or mile deep bluing.... indeed, all metal is left in a as-machined state, and wood is course sanded and protected only by a couple coats of boiled linseed oil. I have also

noticed every action being built has minor, but measurable, differences in non critical areas, giving them an air of true one-offs, but casting doubt on my ability to mass produce anything with unerring precision.

In order to deliver a good gun to each shooter, I feel I must continue to individually hand make, test and fine tune each gun, shooting it on the range and over the chrono for hundreds, or even a thousands or more shots, if that's what it takes. I will, at the same time, be supplying a small spare parts kit, which I feel should be sufficient to keep the gun going for many years, if it's not fiddled with too much.

I had originally felt I needed to make around a dozen guns... now I'm revising my plan to perhaps a maximum of ten, both because it's such a pain to build them, and because I have a few other kinds of airgun I want to make. I now feel even a half dozen guns in the field is more than enough to give proof of concept, and perhaps stir other makers to look at some of my ideas. There is some thought towards having most, if not all parts jobbed out to modern CNC type equipment, and even sent to be blued or anodized, as needed, to make a true production effort out of this, but I'm not so sure there is sufficient demand, nor do I personally have the time to devote to such an undertaking.



Above, some roughed-out parts to be used in the construction of four more air rifles.

But rest assured, I will be shooting this gun in our club matches for a good long while, maybe tinkering a bit more with it, maybe not, as I have other projects waiting too! Retirement is a tough job, but somebody has to do it, right?

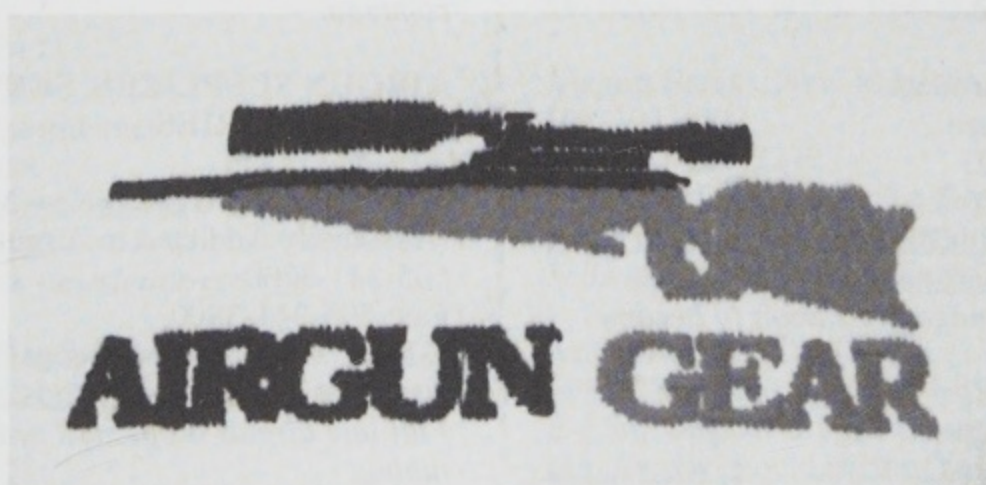
*Fling lead!
Larry Durham*

Update: Just before this book was finalized, we learned that Steve Schulz won the 2002 AAFTA National Championship (open division) with his Larry Durham made air rifle — known as “Simple Simon #2”. Congratulations to both Larry Durham and Steve Schulz.

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954-581-5822

Fax: 954-581-3165

<http://www.gamo.com>

Great Lakes Airguns (New York)

716-648-6666

All major brands and others, including Walther, Gamo, Webley, Air-Arms.

Groenewold, John (Illinois)

847-566-2365

P.O. Box 830

Mundelein, IL 60060-0830

E-Mail: jgairguns@juno.com

<http://www.jgairguns.tripod.com/airgunparts>

Beeman and BSA dealer, factory authorized repairs for Crosman, Benjamin, Sheridan, and Daisy, Titan mainsprings, repairs vintage guns and many other brands, print catalog.

Gunsmithing, Inc. (Colorado)

800-284-8671

Fax: 719-632-3493

E-Mail: neal@nealjguns

<http://www.nealjguns.com>

Sales and service for most brands, including vintage airguns, used airguns.

Online & print catalogs.

Gunter, Dave (Oregon)

503-556-1439

E-Mail: dgunter@ados.com

<http://www.ados.com/~dgunter/index.html>

Airgun repair, restoration, & modification, CO₂ & pneumatic, high-power valve for some Crosman guns.

HART - Robert W. Hart & Son, Inc.

(Pennsylvania)

570-752-6655

401 Montgomery St

Nescopeck, PA 18653

Fax: 570-752-1088

E-Mail: rwhart@earth.sunlink.net

Dealer for the Ultimate Tripod.

Juneau's - Ron, Cajun Targets (Louisiana)

225-261-7435

juneaur@bellsouth.net

Manufacturer of a large variety of field targets

Kendon Pellet Gun Repair (Montana)

406-622-3704

Dealer for BSA, Daisy, Crosman, Benjamin, Sheridan, and Sterling. Custom parts.

Ken's Airsports (Ken Reeves in Ohio)

419-837-6459

Tunes and modifies spring guns, including Air Arms, RWS, and Weihrauch.

Korick, Joe — See Pneumatic Engineering**Lame Rabbit Software**

Jim Baumann

1414 Pine Tree Circle

Wimauma, FL 33598

Markets air rifle ballistics.

Lightforce USA, Inc. (Nightforce Optics)

(Idaho)

208-476-9814

127 Wisconsin St.

Orofino, ID 83544

<http://www.nightforceoptics.com>

Nightforce scopes, Lightforce spotlights for night hunting.

Leupold & Stevens, Inc.

503-646-9171

Fax: 503-526-1455

<http://www.leupold.com>

Scopes & optics for airgunners.

Lutter-Crosman Service Center (Indiana)

219-485-8319

Services Crosman, Benjamin, and Sheridan guns, hard to find parts. Restoration work.

Maccari, James: The Spring Man (Maryland)
410-398-5767

E-Mail: macc4644@zoominternet.net

<http://www0.delphi.com/maccari/>

www.jamesmaccari.com

Makes airgun mainsprings, and performs spring-gun tune-ups, replacement parts, and repair kits.

Mac-1 Airgun (California)

310-327-3581

13974 Van Ness Ave.

Gardena, CA 90249

Fax: 310-327-0238

E-Mail: mac1@cris.com

<http://www.mac1airgun.com>

Manchester Airguns (England)

In USA phone: 011-44-16-1681-7947

In UK phone: 016-1681-7947

Sells and services a wide variety of airguns, will ship most anywhere.

M.C.C. Airguns (Wisconsin)

414-764-2410

Sells Beeman, RWS, BSA, Gamo, and Walther, large selection of used airguns.

Midway USA (Missouri)

800-243-3220

Fax: 573-446-1018

E-Mail: Customer.Service@midwayusa.com

<http://www.midwayusa.com>

Gamo airguns, and accessories ,optics, gunsmithing tools, mounts.

Natchez (Tennessee)

800-251-7839

Fax: 423-892-4482

E-Mail: natchezss@aol.com

<http://www.natchezss.com>

Mail order – sells Gamo, RWS, Tech Force airguns and accessories. Soft airguns, optics, print catalog.

Natural Gear (Arkansas)

1-800-NATGEAR (628-4327)

5310 S. Shackleford, Suite D

Little Rock, AR 72204

<http://www.naturalgear.com>

Camouflage clothing for all types of hunting, catalog available.

Nygord Precision Products (Arizona)

520-717-2315

Fax: 520-717-2198

E-Mail: nygords@northlink.com

<http://www.nygord-precision.com>

Sells and services large assortment of competition airguns, and a pellet sizer, including Steyr, FAS, Pardini, Morini, Walther, and FWB. Five star Beeman dealer.

Oehler Research (Texas)

800-531-5125

<http://www.oehler-research.com>

Manufactures chronograph equipment, catalog and technical information available online.

The Old Western Scrounger (California)

800-877-2666 (orders only) 530-459-5445

Fax: 530-459-3944

E-Mail: oldwest@snowcrest.net

<http://www.snowcrest.net/oldwest/index.html>

Sells airgun pellets and lead balls, check their "Bullets" Web page for details, catalog available.

Payne, Ulysses (Tennessee)

901-465-1249 (after 6:00 p.m.)

Constructs field targets, standard and custom, and related accessories.

Pamona Airguns (California)

760-244-8271

<http://www.pomona-airguns.com>

Complete line of airguns and accessories, scopes, new guns tuned and vintage guns repaired, parts fabrication, Sheridan power modifications.

Pellet Gun Repair (Texas)

817-275-7905 (after 11:30 a.m.)

Factory authorized repair station, repairs older Benjamin, Sheridan & Crosman. Also repairs Chinese airguns.

Pilkingon Competition Equipment

(Tennessee)

931-924-3400

Fax: 931-924-3489

E-Mail: pilkguns@pilkguns.com

<http://www.pilkguns.com>

Sales & service of Steyr-Mannlicher airguns, gunsmith for US Shooting Team.

Pneumatic Engineering (Joe Korick in Washington)
360-546-2981
3509 NW 132nd Circle
Vancouver, WA 98685
E-Mail: joekor@uswest.net
Regulator expert, customized airgun parts.

Precision Airgun Shooting Accessories, Ltd. (PASA) (California)
Bob Winer / 562-430-9183
PO Box 50123
Long Beach, CA 90815
E-Mail: pasaltd@earthlink.net
BKL scope mounts & rings, field target accessories, ballistic software program-Airgun Trajectory Program, U.S. importer of British Nockover brand of field targets.

Precision Pellet (Pennsylvania)
717-382-1481
Fax: 717-382-4065
E-Mail: airgunshop@aol.com
<http://www.airgunshop.com>
Sells and services most brands of airguns, repairs vintage airguns.

Precision Sales International (Massachusetts)
413-562-5055 / 800-221-2613
Fax: 413-562-5056
E-Mail: info@precision-sales.com
<http://www.precision-sales.com/>
Importer of BSA & Anschutz airguns.

Premier Reticles, Ltd. (Virginia)
540-722-0601
Fax: 540-722-3522
E-Mail: reticles@shentel.net
<http://www.premierreticles.com/>
Leupold scopes and accessories, customized reticles built to customers specifications, power modifications, works only on Leupold products.

Price, Tom — See Airgun Gear

Pyramyd Air (Ohio)
888-262-4867, 440-442-2262
Fax: 440-605-1936
E-Mail: pyramydair@aol.com
<http://www.pyramydair.com>
Importer & dealer for Weihrauch, Webley & Scott, Browning/Rutten and Record airguns, AirForce Talon, and CZ air rifles. Sales and service for Russian Anics airguns.

Quackenbush - Dennis (DAQ) (Missouri)
417-993-5262 (phone/fax) / 9 am-8 pm Central
no Sunday calls.
<http://www.connex.net/~daq>
Custom PCP gun maker, big bore airguns, modified airguns, replacement parts for vintage CO₂ airguns.

Reno Airguns (Nevada)
775-323-4698
Sells & services Beeman, Marksman, RWS, Crosman, and Daisy airguns. Also carries accessories, pellets and targets.

RWS (Dynamit Nobel-RWS Inc.) (New Jersey)
201-767-1995
81 Ruckman Road
Closter, NJ 07624
Fax: 201-767-1589
<http://www.dnrws.com>
Importer/distributor of RWS-Diana airguns, and Shin Sung Career airguns. Accessories, parts and service. No direct sales, but a catalog is available.

Steady Aim Harness — See Airgun Gear

Storey Custom Scopes
317-925-5544
3220 Roberta Dr.
Indianapolis, IN 46222
Fax: 317-925-7267
Custom scope modifications, and power boosted scopes.

Stoutenberg, Rick - Field Targets
313-261-1683
Manufacturer of field targets.

Straight Shooters Precision Airguns (Minnesota)
320-240-9062
Fax: 320-259-0759
E-Mail: kgilbri@straightshooters.com
E-Mail: cporter@straightshooters.com
<http://www.straightshooters.com>
Sells a wide variety of airguns and accessories, including Beeman, RWS, Air Arms, and Crosman. Online information and data on most airguns.

Theoben Engineering (England)

01487 740744

West Newlands, Somersham

Cambridgeshire PE28 3EB England

Fax: 01487 740040

E-Mail: theoben@zetnet.co.uk<http://www.theoben.co.uk>*Manufacturer of gas-ram and pre-charged pneumatic airguns.***Top Gun Air Guns** (Arizona)

480-513-3778

8442 East Hackamore Dr.

Scottsdale, AZ 85255

www.topgunairguns.com*Importers of Air Arms, Drulov, TAU, & Aeron airguns.***The Ultimate Tripod — See HART - Robert W. Hart & Son, Inc.****Ulysses Steel Critters** (Tennessee)

(901) 465-1249

530 Emily Rd.

Oakland, TN 38060

*Manufacturer of spring loaded field targets.***Walker's Game Ear, Inc.**

800-424-1069

PO Box 1069

Media, PA 19063

<http://www.WalkersGameEar.com>*High quality hearing enhancement and protection devices.***Webley & Scott Limited** (England)

In U.S. 011-44-121-453-1864

Fax: 011-44-121-457-7846

In U.K. 0121-453-1864

Fax: 0121-457-7846

<http://www.webley.co.uk/index.html>*Manufactures, sells and services Webley airguns.***Whiscombe Airguns** (England)

00 44 (0) 1635 43489

E-Mail: john.whiscombe@btinternet.com
info@whiscombe.com<http://www.webdev100.fsnet.co.uk/index.html><http://www.whiscombe.com>

John Whiscombe

Runways / Stoney Lane

Ashmore Green, Thatcham, Berks RG18 9HG

In the US contact Pelaire Products

5346 Bonky Ct.

West Palm Beach, FL 33415

Fax: 561-967-0052

Wind flags (airgun sensitive)

Dearl Lang 417-678-4054

HL Wickham 540-962-4873

Zasadny - Allen (Illinois)

847-838-0187

Modifications for Career, Anschütz, and many other PCP airguns.

A P P E N D I X B

State Sources for Hunting Information and Regulations



Alabama

Alabama Dept. of Conservation & Natural
Resources
64 N. Union Street
Montgomery, AL 36130
334-242-3465
www.dcnr.state.al.us/agfd

Alaska

Division of Wildlife Conservation
P.O. Box 25526
Juneau, AK 99802-6197
907-465-6197
www.state.ak.us/local/akpages/fish.game/wildlife

Arizona

Arizona Game and Fish Dept.
2221 W. Greenway Road
Phoenix, AZ 85023-4312
602-942-3000
www.gfd.state.az.us

Arkansas

Arkansas Game & Fish Commission
2 Natural Resources Drive
Little Rock, AR 72205
800-354-4263
www.agfc.state.ar.us

California

California Dept. of Fish & Game
1416 Ninth Street
Sacramento, CA 95818
916-227-2244
www.cfg.state.ca.us

Colorado

Colorado Division of Wildlife
1313 Sherman, Room 718
Denver, CO 80203
303-297-1192
<http://wildlife.state.co.us>

Connecticut

Connecticut Dept. of Environmental Protection
79 Elm Street
Hartford, CT 06106-5127
800-424-3105
<http://dep.state.ct.us/pao>

Delaware

Delaware Division of Fish and Wildlife
89 Kings Highway
Dover, DE 19901
302-739-4431
www.dep.state.ct.us/burnatr/wildlife

Florida

Florida Dept. of Game and Freshwater Fish
620 S. Meridian Street
Tallahassee, FL 32399-1600
850-488-4676
www.state.fl.us/gfc

Georgia

Georgia Dept. of Natural Resources
Wildlife Management Division
2111 Highway 278
Social Circle, GA 30025
770-918-6416
www.ganet.org/dnr

Idaho

Idaho Dept. of Fish & Game
P.O. Box 25
Boise, ID 83707
208-334-3700
www.state.id.us/fishgame

Illinois

Illinois Dept. of Natural Resources
524 S. Second Street, Room 210
Springfield, IL 62701
217-782-2965
www.dnr.state.il.us/ildnr

Indiana

Indiana Dept. of Natural Resources
402 W. Washington Street
Indianapolis, IN 46204
317-232-4080
www.dnr.state.in.us

Iowa

Iowa Dept. of Natural Resources
Wallace State Office Building
Des Moines, IA 50319-0034
515-281-5145
www.dnr.state.ia.us

Kansas

Kansas Parks and Wildlife
900 SW Jackson Street, Suite 502
Topeka, KS 66612-1233
785-273-6740
www.kdwp.state.ks.us

Kentucky

Kentucky Dept. of Wildlife Resources
1 Game Farm Road
Frankfort, KY 40601
502-564-4336
www.state.ky.us/agencies/fw/kdfwr.htm

Louisiana

Louisiana Dept. of Wildlife & Fisheries
P.O. Box 98000
Baton Rouge, LA 70898
504-765-2980
www.wlf.state.la.us

Maine

Maine Dept. of Inland Fisheries & Wildlife
285 State Street
41 State House Station
Augusta, ME 04333-0041
207-287-2571
webmaster_ifw@state.me.us

Maryland

Maryland Dept. of Natural Resources
Wildlife Division
580 Taylor Ave., E-1
Annapolis, MD 21401
401-260-8540
www.dnr.state.md.us/huntersguide

Massachusetts

Massachusetts Dept. of Fisheries & Wildlife
Field Headquarters
Westboro, MA 01581
508-792-7270, ext.110
www.state.ma.us/dfwele

Michigan

Michigan Dept. of Natural Resources
4590 118th Ave., Route 3
Allegan, MI 49010
517-373-1230
www.dnr.state.mi.us

Minnesota

Minnesota Dept. of Natural Resources
500 Lafayette Road
St. Paul, MN 55155-4026
651-296-4506
www.dnr.state.mn.us

Mississippi

Mississippi Dept. of Wildlife
2906 North State Street
Jackson, MS 39205
800-546-4868
www.mdfo.state.ms.us

Missouri

Missouri Dept. of Conservation
P.O. Box 180
Jefferson City, MO 65102
573-751-4115
www.dnr.state.mo.us

Montana

Montana Fish, Wildlife, & Parks
1420 E. Sixth Ave.
Helena, MT 59620
406-444-2535
<http://fwf.state.mt.us>

Nebraska

Nebraska Game and Parks
2200 N. 33rd Street
Lincoln, NE 68503
402-471-5003
www.ngpc.state.ne.us

Nevada

Nevada Division of Wildlife
P.O. Box 10678
Reno, NV 89520
702-688-1500
www.ndw.state.nv.us

New Hampshire

New Hampshire Fish & Game Dept.
2 Hazen Drive
Concord, NH 03301
603-271-3211
www.wildlife.state.nh.us

New Jersey

New Jersey Division of Fish, Game, & Wildlife
P.O. Box 400
Trenton, NJ 08625-0400
609-292-2965
www.state.nj.us/dep/fgw

New Mexico

New Mexico Dept. of Game & Fish
P.O. Box 25112
Santa Fe, NM 87504
505-827-7911
www.gmfs.state.nm.us

New York

New York Dept of Environmental Conservation
Wildlife Division
50 Wolfe Road
Albany, NY 12233
518-457-3521
www.dec.state.ny.us

North Carolina

North Carolina Wildlife Resources Commission
512 N. Salisbury Street
Raleigh, NC 27640
919-662-4370
www.ncwildlife.org

North Dakota

North Dakota Game & Fish Dept.
100 N. Bismarck Expressway
Bismarck, ND 58501-5095
701-328-6300
www.state.nd.us/gnf/hunting

Ohio

Ohio Division of Wildlife
1840 Belcher Drive
Columbus, OH 43224
614-265-6300
www.dnr.state.oh.us/odnr/wildlife/hunting

Oklahoma

Oklahoma Division of Wildlife
1801 N. Lincoln Blvd.
Oklahoma City, OK 73152
405-521-3853
www.odr.state.ok.us

Oregon

Oregon Dept. of Fish & Game
P.O. Box 59
Portland, OR 97207
503-872-5270
www.odfg.state.or.us

Pennsylvania

Pennsylvania Game Commission
2001 Elmerton Ave.
Harrisburg, PA 17110
717-787-4250
www.pcg.state.pa.us

Rhode Island

Rhode Island Fish & Wildlife
Oliver Steadman Government Center
480 Tower Hill Road
Wakefield, RI 02879
401-789-3094
www.state.ri.us

South Carolina

South Carolina Dept. of Natural Resources
Wildlife Division
P.O. Box 167
Columbia, SC 29202
803-734-3843
www.dnr.state.sc.us

South Dakota

South Dakota Dept. of Game, Fish, & Parks
523 East Capitol
Pierre, SD 57501
605-773-3485
www.state.sd.us

Tennessee

Tennessee Wildlife Resource Agency
Ellington Agricultural Center
Nashville, TN 37302
615-781-6580
www.state.tn.us

Texas

Texas Parks & Wildlife
4200 Smith School Road
Austin, TX 78744
512-389-4820
www.tpwd.state.tx.us/hunt

Utah

Utah Wildlife Resources
1594 West, North Temple, Suite 2110
Salt Lake City, UT 84114-6301
801-538-4700
www.nr.state.ut.us

Vermont

Vermont Dept. of Fish & Wildlife
103 S. Main Street
10 South Building
Waterbury, VT 05671-0501
802-241-3700
www.dnr.state.vt.us/fw/fwhome

Virginia

Virginia Dept. of Game & Inland Fisheries
P.O. Box 11104
Richmond, VA 23230-1104
804-367-1000
www.dgif.state.va.us

Washington

Washington Dept. of Fish & Wildlife
600 Capitol Way N.
Olympia, WA 98501-1091
360-902-2464
www.wa.gov/wdfw

West Virginia

West Virginia Dept. of Natural Resources

Wildlife Division

1900 Kanawha Blvd. E.

Capitol Complex, Bldg 3

Charleston, WV 25305

304-558-3380

www.wvdnr.state.wv.us

Wisconsin

Wisconsin Dept. of Natural Resources

Box 7921

Madison, WI 53707

608-266-2621

www.dnr.state.wi.us

Wyoming

Wyoming Game & Fish Dept.

5400 Bishop Blvd.

Cheyenne, WY 82006

307-777-4600

<http://gf.state.wy.us>



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